

Harvard School Of Public Health

OFFICIAL
REGISTER OF
HARVARD
UNIVERSITY

1979/80



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Official Register of Harvard University

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Every effort is made to insure the information contained in this catalog is accurate at the time of publication. However, the School of Public Health reserves the right to make changes without notice in tuition and fees, admission and degree requirements, courses of instruction, and any other information contained herein.

As a matter of policy, Harvard University does not discriminate among applicants and students in admissions, educational policies, scholarship and loan programs, and athletic and other programs on the basis of race, religion, sex, national origin, color, creed, handicap, or age.

Cover

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Academic Calendar, 1979-80

***September 11, Tuesday**

Opening orientation session and preliminary registration for new international students

***September 12, Wednesday**

Opening orientation session and preliminary registration for new U.S. students

September 13, Thursday and September 14, Friday

Registration for continuing students

Students who fail to register by the appropriate dates will be assessed a late registration fee.

The period between the opening sessions and September 17 will be devoted to orientation lectures, individual conferences with faculty members, and selection of courses of study.

*All new students are required to attend the opening session and to be present for the registration period.

Fall Term, September 17, 1979 through January 18, 1980

September 17, Monday

First period courses begin

October 3, Wednesday

Last day to register for Fall Term

October 8, Monday

Columbus Day, a holiday

November 9, Friday

First period ends

November 12, Monday

Veterans' Day, a holiday

November 13, Tuesday

Second period courses begin

November 22, Thursday through

November 25, Sunday

Thanksgiving recess

Recess from Tuesday, December 18, 1979 through Wednesday, January 2, 1980

January 18, Friday

Second period courses end

January 21, Monday through

January 25, Friday

Supervised special studies or field observations

January 25, Friday

Registration for new students

Spring Term, January 28, 1980 through June 5, 1980

January 28, Monday

Third period courses begin

February 13, Wednesday

Last day to register for Spring Term

February 18, Monday

Washington's Birthday, a holiday

March 21, Friday

Third period ends

Recess from Sunday, March 23, 1980 through Sunday, March 30, 1980

March 23, Monday

Fourth period courses begin

May 23, Friday

Fourth period ends

May 26, Monday

Memorial Day, a holiday

May 27, Tuesday through

June 4, Wednesday

Supervised special studies or field observations

June 5, Thursday

Commencement

Degree Calendar

For a diploma for a degree to be awarded in:

November, 1979

March, 1980

June, 1980

Degree applications are due in Registrar's Office on:

September 14, 1979

November 30, 1979

April 1, 1980

Bound theses are due in the Registrar's Office on:

October 10, 1979

February 20, 1980

May 29, 1980

Administration

The University

President and Fellows of Harvard College

(This Board is commonly known as the Corporation.)

Derek Curtis Bok, A.B., J.D., A.M., LL.D., President

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Hugh Calkins, A.B., LL.B., Fellow of Harvard College

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Robert Gregg Stone, Jr., A.B., Fellow of Harvard College

George Putnam, A.B., M.B.A., Treasurer of Harvard College

Robert Shenton, A.B., M.B.A., Ph.D., Secretary to the Corporation

Frances Mary Gabron, Assistant Secretary to the Corporation

The School of Public Health

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Emily Kramer Morrison, S.B., Assistant to the Dean and Affirmative Action Officer

Sue Robinson, A.B., Registrar

Margaret Catherine Salmon, S.B., Assistant to the Dean for Faculty Administration and Director of Financial Aid

Raymond Kenneth Neff, A.B., S.M. in Hyg., S.D. in Bio., Director of the Health Sciences Computing Facility

Norman Henry Peterson, Manager of Facilities and Administrative Services

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Linda Vaughan, A.B., Ed.M., Director of Counseling

James Joseph Feeney, A.B., M.D., Director of the Medical Area Health Service

C. Robin LeSueur, B.A., B.S.W., M.L.S., Librarian, Francis A. Countway Library of Medicine

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John Milton Peters, M.D., Director of the Educational Resource Center for Occupational Health and Safety

Alan Sheldon, D.P.M., S.M. in Hyg., Director of Executive Programs in Health Policy and Management

Thomas Huckle Weller, A.B., S.M., M.D., LL.D., Director of the Center for the Prevention of Infectious Diseases

James Laverre Whittenberger, S.B., M.D., A.M. (hon.), Director of the Kresge Center for Environmental Health

Jay Andrew Winsten, A.B., Ph.D., Director of the Office of the Health Policy Information

Joe David Wray, A.B., M.D., M.P.H., Director of the Office of International Health

A Note from the Dean

The School's primary missions are the education of scholars who seek to understand and ameliorate the health problems of society, the execution of the research that addresses those problems, and the training of professionals who deal with them. The scope of its teaching and research programs extends all the way from the development of concepts and methods through studies of natural phenomena and of policy development, to the ultimate steps of implementation and evaluation. The School's programs concern two major areas. The first is disease prevention and involves the biological, chemical, physical and social factors that affect the health of society. The second is the organization and function of systems involved in the delivery of health services.

Public health is not itself a discipline, but its practitioners require expertise in one or more of a group of disciplines. The increasing complexity of public health questions requires the skills of quantitative analytic, natural, behavioral, social, and managerial scientists. The academic programs of the School must impart a sound background in a basic discipline as well as an active and credible experience in the application of the discipline to health problems. They must also demonstrate how people from different disciplines can cooperate in approaches to health problems.

We are a professional school. Strong training programs are required for new health professionals and for those in mid-career status. Health care systems in this country and abroad require professionals well-equipped to plan and manage the use of resources. With recent and prospective changes in health policy in the United States, our professional graduates must be equipped to anticipate, encourage and deal with change, and to be among its leaders. In our complicated society, critical problems in areas such as occupational health, nutrition, population, and pollution of the air, the soil and the water all share certain characteristics. A better data base of solid scientific information is essential, but inadequate by itself, to equip professionals to identify and implement socially appropriate and effective policy. Resources are scarce, and costs and benefits must be calculated. Large organizations must often be influenced to change their behavior and large groups of people mobilized to implement new policies. And this must be done in a context in which available data are incomplete, inference difficult, and the world not well understood.

The School's professional programs, therefore, must be based on both natural and social sciences and must depend heavily on quantitative analytic methods. The programs must emphasize a symbiotic relationship between our historically strong areas and a potentially unique set of analytic and managerial skills applied to health — all of which are needed to improve public health in the current context. This is true not only for degree programs designed to train new health professionals, but also for our efforts to rapidly assist today's public health professionals by making available strong mid-career educational opportunities.

The School has traditionally sponsored programs directed at the health problems of the developing world. Disease, malnutrition, population excess relative to resources, and the closely linked problems of economic under-development and ignorance are of great professional concern to much of our faculty and student body. That the School should be concerned with these critical problems is generally agreed. The question of appropriate roles for the School in this area is now receiving much faculty attention, and will surely be guided by the judgment and advice of colleagues from developing countries. As health programs in those countries evolve, continuing change in our programs can (and should) be anticipated.

The boundaries of public health are ever widening, and this School has assumed a leadership role in that process. It is continuing its commitment to traditional public health approaches and integrating them with approaches more recently identified as important. Our students must gain an appreciation of, and participate in, the major contributions to health made by a growing circle of disciplines.

Howard H. Hiatt

Degree Requirements

The School of Public Health offers programs leading to the graduate degrees of *Master of Public Health* (M.P.H.), *Doctor of Public Health* (Dr.P.H.), *Master of Industrial Health* (M.I.H.), *Master of Science* in a specified field (S.M. in . . .), and *Doctor of Science* in a specified field (S.D. in . . .). The general degree requirements and the respective requirements for admission are discussed in the following sections.

Master of Public Health

The program leading to the Master of Public Health degree consists of one academic year of study designed to prepare existing health professionals for careers in public health practice. Through the core curriculum, the program provides a broad background in various disciplines basic to public health. Through the choice of elective courses (expected to constitute half or more of the student's program) students may acquire more breadth of knowledge or may pursue in some depth one or more areas of particular relevance to their career goals.

Requirements for Admission

Applicants to the M.P.H. program must satisfy the Committee on Admissions and Degrees as to their academic ability, the relevance of their previous education and experience, and their overall qualifications for graduate professional education in public health. Ordinarily, an applicant should hold a doctoral degree in medicine, dentistry, veterinary medicine. Consideration is also given to applicants who hold doctoral degrees in biology, behavioral sciences, other natural sciences and social sciences, or law, economics, engineering, and certain related fields regarded by the School as appropriate background for entrance into the public health profession. Applicants who hold an earned doctoral degree are urged to submit scores from the Aptitude Test of the Graduate Record Examination (GRE) or other aptitude tests such as the Law School Admission Test (LSAT) or the Medical College Admission Test (MCAT), if available.

Consideration for admission to the M.P.H. program is given also to an applicant who holds a master's degree in a field related to public health such as nursing or social work, with a highly distinguished academic record, and substantial professional experience. These applicants must be able to demonstrate sufficient knowledge and competence to satisfy the Committee on Admissions and Degrees as to their qualifications for professional public health education and must submit scores from the Aptitude Test of the Graduate Record Examination. Scores from the GRE Aptitude Test should be no more than five years old.

Combined Degree Programs: M.P.H. with M.D., D.M.D., D.D.S., and D.V.M.

Students currently enrolled in an M.D. or D.M.D. program may apply for admission to the M.P.H. program, provided that a combined program can

be arranged that meets the approval of both the Committee on Admissions and Degrees and the institution from which the doctoral degree is being earned. Students usually apply in their second or third year of medical, dental, or veterinary school.

Requirements for the Degree

An M.P.H. degree candidate must spend one academic year in residence at the University and must successfully complete courses totaling a minimum of 40 credit units. Students will be encouraged to take a total of 45 to 50 credit units

Candidates for the M.P.H. degree are expected to complete the requirements in one academic year of full-time study. In rare instances, upon written request to the Committee on Admissions and Degrees, a student may be allowed to complete the program over a period of two academic years. The M.P.H. core courses must be completed in the first year.

Students who have taken courses at the School prior to entrance into this degree program may be able to use those courses to satisfy specific M.P.H. or departmental course requirements, but such courses would not ordinarily reduce the minimum credit requirement. In any event, students are required to pay one full year of tuition.

Combined Degree Programs

Students enrolled in a combined degree program with the M.P.H. will receive both degrees upon successful completion of both degree programs.

The Core Curriculum

Beginning in the 1979-80 academic year, six courses will make up the core curriculum for the M.P.H. degree program. The core courses will be required of all newly enrolled M.P.H. degree candidates. Four of the required courses are designed to give all M.P.H. students a common knowledge of the major areas of public health — the environment, quantitative methods, and health policy and management. They are:

Environmental Health Interdepartmental 201a,b (or 201c,d)
(5 credit units)

Biostatistics 101a,b (5 credit units)

Epidemiology 201a,b (2.5 credit units)

* Health Services Administration-

Health Policy and Management 201a,b (5 credit units)

In addition, students will select one of two case studies courses which will be held in the spring semester. Using the case method students will integrate disciplines for the purpose of finding solutions to problems in public health. These courses are:

Microbiology 201c,d (5 credit units)

Health Policy and Management ---d (2.5 credit units) —
(To Be Developed)

The core curriculum will represent either 20 or 22.5 credit units depending upon the case studies course selected. This is less than half of the total number of credit units recommended for the degree, thus allowing for

flexibility in the program. Descriptions of the core courses appear under the departments in the section, *Courses of Instruction*.

International Track

Students interested in following the international track in the 1979-80 academic year will be required to take the following courses in addition to the core courses:

- Interdepartmental 209a,b (2.5 credit units)
- plus 2 of the following 3:
- Population Sciences 200a,b (2.5 credit units)
- Nutrition 210a,b (2.5 credit units)
- Tropical Public Health 201a (3 credit units)

Master of Public Health Program Committee

The Master of Public Health Program Committee is composed of three coordinators, a faculty representative of each department at the School, and representatives of students, alumni, and the School administration. The coordinators and committee oversee all M.P.H. programs, including admissions, and are responsible for developing long-range plans for the objectives and content of the M.P.H. program.

Doctor of Public Health

The Doctor of Public Health is an advanced professional degree for those who intend to pursue academic or research careers in public health, including administrative, planning, or evaluation roles in public health practice. The degree is granted on successful completion of an approved program of independent and original investigation in a special field of public health and the presentation of the results of this research in an acceptable thesis.

Requirements for Admission

An applicant for admission to candidacy for the Doctor of Public Health degree normally must be a graduate of an approved school of medicine, dental medicine, or veterinary medicine. Depending on the intended field of specialization, consideration may also be given to a candidate who holds an advanced degree in one of the disciplines basic to public health. In addition, the applicant must hold, or be in progress toward, the degree of Master of Public Health, or its equivalent, from an approved institution.

Applicants must be able to satisfy the Committee on Admissions and Degrees as to their overall qualifications for doctoral study at the School and must demonstrate potential ability to undertake original investigation in a special field. Scores for the Aptitude Test of the Graduate Record Examination must be submitted by all applicants, and should be no more than five years old.

Applicants who hold an earned doctoral degree are urged to submit aptitude scores from the GRE, or other tests as LSAT, or MCAT, if available.

Requirements for the Degree

Formal requirements for the Doctor of Public Health degree are the same as

those for the Doctor of Science degree. A brief summary of these requirements appears on pp. 15-17.

Master of Industrial Health

The program leading to the Master of Industrial Health degree is designed to provide physicians with postgraduate training in the public health disciplines that are relevant to the development of programs to prevent occupational disease and injury. This one-year degree program may be taken as part of a two-year approved residency in occupational medicine, or it may be taken as an independent one-year program.

Requirements for Admission

Candidates must be graduates of an approved school of medicine and must satisfy the Committee on Admissions and Degrees as to their scholastic ability to study at the graduate level. Students from the United States must have completed an internship or residency of at least twelve months in a hospital approved by the American Medical Association. Applicants are urged to submit scores from the Medical College Admissions Test (MCAT) or the scores of the Aptitude Test of the Graduate Record Examination (GRE), if the latter are available.

Requirements for the Degree

Candidates for the M.I.H. degree must spend one academic year in residence at the University and must successfully complete a program of at least 40 credit units, comprising both required and elective courses.

All candidates are expected to take the following courses unless they can demonstrate equivalent preparation:

1. Biostatistics 101a,b, *Principles of Biostatistics* (5 credits)
2. Epidemiology 201a, *Principles of Epidemiology* (2.5 credits)
3. Environmental Health Interdepartmental 201a,201b, *Principles of Environmental Health* (5 credits)
4. Either Environmental Health Sciences 271a,b, *Introduction to Radiation Protection* (5 credits) or Physiology 207c,d, *Radiation Biology* (4 credits)
5. Environmental Health Interdepartmental 207c,d, *Policy Issues in Occupational Health* (5 credits)
6. Environmental Health Interdepartmental 251c,d, *Basic Problems in Occupational Health and Industrial Environments* (5 credits)

The total number of credits in required courses is thus either 26.5 or 27.5, depending on whether Environmental Health Sciences 271a,b or Physiology 207c,d is elected. Additional courses may be selected from the curriculum approved for residencies in occupational medicine.

Master and Doctor of Science in Specified Field

The School offers programs leading to the degrees of Master and (in most cases) Doctor of Science in designated fields of concentration. The prospective applicant should note that in some areas, the Master of Science program is intended primarily or wholly as preparation for doctoral study; applicants are screened for their interest in, and potential for, doctoral work, and the majority of students continue toward the Doctor of Science degree. In other areas, the Master of Science is viewed primarily or wholly as a terminal degree; while a small percentage of students may continue for the doctorate, the majority discontinue study upon receipt of the S.M. degree. Finally, students in still other areas are divided almost equally between those who pursue the Doctor of Science degree and those who discontinue their studies upon receipt of the S.M. degree.

Occasionally, a student may be admitted to a master's program or to candidacy for a doctoral degree in more than one of the disciplines, if the program meets the requirements of the respective departments or programs involved. In such instances, the degree conferred specifies the areas.

Because there is considerable variability among the S.M. and S.D. programs in different fields, both in their overall goals and their specific admission and degree requirements, students are urged to consult the program descriptions. These descriptions provide basic information about programs in specific areas; additional information may be obtained by contacting the respective departments or programs, as indicated in the degree designation.

Joint Department Degree

With the permission of the departments, students may seek a Master of Science or Doctor of Science degree from two departments within the School.

Master of Science in Specified Field

In general, the programs leading to the degree of Master of Science in a specified field of concentration are designed for students with interests in the scientific basis of public health and preventive medicine. The degree is granted upon fulfillment of a program of advanced work in the public health disciplines represented by departments and certain programs in the School. Students may be admitted to either a one- or a two-year master's program, depending upon the requirements of the particular program. Information about requirements for one- and two-year programs in various areas is included in the program descriptions.

Requirements for Admission

Applicants to Master of Science degree programs must satisfy the Committee on Admissions and Degrees as to their overall qualifications and promise for successful graduate study at the School. Applicants must also satisfy the department or program to which admission is sought that they have an adequate academic and/or professional background appropriate for specialization in that field.

Conditions of eligibility for one-year or two-year programs vary with the area or department in which a student wishes to specialize. Prospective applicants should consult program descriptions for more specific information.

Generally, eligibility for admission to a one-year program is limited to graduates of approved schools of medicine, dentistry, or veterinary medicine, or to applicants who have earned doctoral or, for some programs, master's degrees in fields acceptable to the department(s) to which admission is sought. Applicants holding master's degrees may be considered for admission to one-year or to two-year programs, depending upon their prior educational and professional background and upon the particular requirements of the program to which they wish to apply.

An applicant holding a baccalaureate degree is normally considered for admission to a two-year program, in order to complete the requirements for a Master of Science degree. For a few programs, including industrial hygiene, air pollution control, and radiological health, applicants may be considered for a one-year program if they hold a bachelor's degree with adequate scientific and engineering training and if they have had at least two years of relevant professional experience in the field of specialization.

Occasionally, a year or more of appropriate graduate work in an approved institution may enable a student to fulfill two-year program requirements in one year. In some cases, however, program requirements are such that a student must spend one-and-a-half or two years in residence in order to complete the necessary courses, regardless of prior training and experience.

All candidates for admission to a Master of Science program must submit scores from the Aptitude Test of the Graduate Record Examination. Applicants who hold an earned doctoral degree are urged to submit scores from the GRE or other tests such as the Law School Admission Test (LSAT) or the Medical College Admission Test (MCAT), if available.

An Advanced Test of the Graduate Record Examination may be required in some programs if the applicant's undergraduate major is in one of the following fields: biology, chemistry, economics, engineering, mathematics, physics, political science, psychology, or sociology. Applicants are advised to take the Graduate Record Examination no later than the December test administration date. In order to expedite the admissions process, applicants who have taken the Graduate Record Examination in a prior academic year are advised to send a photocopy of their own G.R.E. "Report to the Candidate" when returning their completed application form. GRE scores submitted should be no more than five years old. An official score report must be received from the Educational Testing Service before final action will be taken on the application. Additional information concerning the Graduate Record Examination requirement is included in the instructions accompanying the application form.

Requirements for the Degree

Students admitted to a one-year program must spend a minimum of one academic year in residence at the University and must successfully complete a program of at least 40 credit units. Students admitted to a two-year program must spend two academic years in residence and must successfully complete a program of at least 80 credit units.

While specific course requirements vary from program to program, all candidates for a Master of Science degree are required to take Biostatistics 101a,b and Epidemiology 201a, unless they can demonstrate equivalent preparation. Candidates who do not have a background in medicine or biology are advised to take Physiology 203a,b, or its equivalent, or a course in general biology elsewhere. Beyond these minimal course requirements, each program may specify additional courses that are necessary for satisfactory fulfillment of degree requirements in the particular area of specialization. These specific course requirements are generally *not* listed in this catalog. The student should consult with his or her adviser or department or program head about these requirements before deciding which courses to take.

Combined Degree Programs

The admission and degree requirements for the Master of Science degree are the same those listed for Master of Public Health degree.

Doctor of Science in Specified Field

The Doctor of Science degree is an advanced graduate degree for those who intend to pursue academic or research careers in public health. The degree is granted on successful completion of a program of independent and original research in one of the basic disciplines of public health, and upon the presentation of this research in an acceptable thesis.

Requirements for Admission

Applicants for admission to candidacy for a Doctor of Science degree must satisfy the Committee on Admissions and Degrees and the department of specialization as to their overall qualifications for doctoral study and their ability to undertake original research in their chosen field. All candidates for a Doctor of Science degree must hold a baccalaureate degree. In some instances, an applicant will be expected to complete the Master of Science degree at the School before being granted full admission to doctoral study. In such cases, the student will first be admitted to a Master of Science program. Scores for the Aptitude Test of the Graduate Record Examination must be submitted by all applicants to doctoral programs and should be no more than five years old. Applicants who hold an earned doctoral degree are urged to submit Aptitude Test scores from the GRE, or LSAT, or MCAT test, if available.

Because specific prerequisites vary with the discipline or field of specialization, prospective applicants are urged to consult the program descriptions in this catalog and the department or program to which admission is sought for more detailed information.

Requirements for the Degree

A minimum of two academic years of full-time study in residence at the University is required of students enrolled in the doctoral program. The required work and preparation of an acceptable thesis, however, frequently takes longer. Residence requirements are fulfilled by payment of tuition (see pp. 70, 72) and pursuit of an academic program approved by the department of concentration and the Committee on Admissions and Degrees.

The Committee on Admissions and Degrees is responsible for overseeing the programs of all doctoral students. During the registration period each new doctoral student will receive a manual detailing the principles and procedures that are to be followed. A brief summary of requirements is given below.

Each doctoral student is required to take 40 to 60 credits in graduate-level courses distributed over a major and two minor fields. Each minor field will ordinarily consist of at least 10 credits in formal courses. Such requirements may be reduced in cases of prior relevant coursework or experience. They may be increased in cases where there has been a substantial shift in field. Courses in the major and minor fields must be completed with distinction, with grades of "A" or "B", beginning in the fall of 1979. Departments may stipulate specific course requirements and may require written and/or oral examinations on the coursework in the three fields.

Qualifying Examination

By the end of the second year the student should be prepared to take the oral qualifying examination. The main emphasis of this examination is to assess the student's potential to perform research in his/her chosen field. Since most doctoral research in the School requires a substantive knowledge of more than one discipline or field, the examining committee will include faculty from disciplines representing the minor fields as well as the major. The examination will include questioning in the major and minor fields outside of the proposed research.

A research committee consisting of the student's adviser and other faculty members is to be appointed within one month after the qualifying examination is passed. This committee has the responsibility for guiding the student's research through to completion. It will meet with the student at least once every six months to discuss details of the student's progress.

Thesis

An acceptable thesis must ordinarily be submitted within five years of the date of registration as a doctoral candidate. The thesis should consist of one or more manuscripts suitable for publication in a scientific medium appropriate to the candidate's field. Detailed requirements are available from the Registrar.

The thesis will not be accepted until a public presentation and discussion has been held, with the research committee in attendance.

Three bound copies of the approved thesis must be in the Registrar's Office before the faculty will vote the degree at its special meetings in October, February, or June.

Occasionally thesis work will be performed *in absentia*. Before the doctoral subcommittee of the CAD grants such status, it is necessary that the research committee meet with the candidate to appraise the thesis plan. Agreement must be reached and the doctoral subcommittee must be advised in writing *before departure of the student* as to (1) acceptability and feasibility of the proposed thesis plan; (2) the timing and scope of the periodic written reports that will be required of the student; (3) arrangements that have been made or will be made for direct field supervision of the student; and (4) the minimum period of time the student will spend back at the School before the presentation and defense of the thesis. In no case will the doctoral subcommittee grant *in absentia* status for more than one year at a time.

Students wishing further information on doctoral program requirements should contact the Registrar's Office.

Residency for Board Certification

The School offers approved residency training leading to certification by the American Board of Preventive Medicine in the following areas:

- General Preventive Medicine, in the specialty areas of
 - Epidemiology
 - Health Services Administration
 - International Health
- Occupational Medicine

For physicians accepted into a General Preventive Medicine or Occupational Medicine Residency, credit is given for one, two, or three years of study leading to one or more public health degrees. A residency may also include supervised experience which may or may not be part of a doctoral program.

Additional information about the residency programs may be obtained from Dr. Brian MacMahon, Head of the Department of Epidemiology (for the specialty area of epidemiology of the General Preventive Medicine residency); Dr. Alonzo Yerby, Professor of Health Services Administration (for the specialty area of health services administration of the General Preventive Medicine residency); Dr. Manuel Herrera-Acena, Associate Professor of Medicine in the Department of Nutrition (for the specialty area of international health of the General Preventive Medicine residency); and Dr. John Peters, Professor of Occupational Medicine (for the Occupational Medicine residency).

None of the residencies as such involves stipend or other financial support. Some financial support may be available through traineeships or National Research Service awards for degree programs (U.S. citizenship or permanent residence status required). Further information on financial aid can be obtained from the individuals listed above, or from Ms. Margaret C. Salmon, Director of Financial Aid.

Postdoctoral Fellowship Program in Dental Public Health and Dental Care Administration

The School of Dental Medicine, in cooperation with the School of Public Health and the Massachusetts Department of Public Health, offers a program covering three academic years of postdoctoral study, intended to prepare a limited number of individuals for creative full-time teaching, research, and/or administrative careers in dental public health and dental care organization. Each person accepted into the program will be appointed as a Clinical or Research Fellow in Dental Care Administration at the School of Dental Medicine. The program is open to dentists and other qualified health professionals.

The program is in three parts of approximately one year each, which need not be completed in succession. One part of the program involves a formal course leading to a degree of Master of Public Health. The M.P.H. core courses must be completed in the first year at the School of Public Health and all requirements for the Master of Public Health degree in a maximum of two academic years. Candidates with an M.P.H. or equivalent from another school, however, may be accepted into the Postdoctoral Fellowship Program with one year advanced standing. The second portion involves a one-year supervised residency at the community, state, or national level in health policy and administration. This residency meets the requirements of the American Board of Dental Public Health. The third portion affords opportunity for advanced didactic work and research at the School of Dental Medicine, the School of Public Health, other departments of the University, and/or other institutions. Epidemiological or health services research can be carried on over the entire three-year period in a variety of situations involving either new or continued studies. A research thesis is prepared for presentation at the end of the third year.

Fellows in Dental Care Administration who wish to become candidates for a degree in public health must meet the admission requirements of and be accepted into the School of Public Health. Application should be made directly to the School of Dental Medicine, whose Committee on Postdoctoral Education will forward the applicant's file to the School of Public Health for consideration.

Upon successful completion of this program, the candidate will receive the M.P.H. degree from the School of Public Health, as well as a Certificate of Postdoctoral Study in Dental Care Administration and a certificate of completion of residency requirements from the Harvard School of Dental Medicine.

Academic study beyond the master's level may be arranged with the School of Public Health and other departments of the University.

For further information and application forms, write to the Head, Department of Dental Care Administration, Harvard School of Dental Medicine, 188 Longwood Avenue, Boston, Massachusetts 02115.

Departments and Programs

Department of Behavioral Sciences

William E. McAuliffe, A.B., A.M., and Ph.D., Associate Professor of Sociology in the Faculty of Public Health and the Faculty of Arts and Sciences and Acting Head of the Department

Faculty

Professor and Visiting Professor Hamburg and Mertens; Associate Professors Masnick and Benfari; Assistant Professors Gortmaker, McAlister, Radius, and Walker; Lecturer Wechsler

Teaching and Research Staff

Research Associate Eckenrode

Introduction

The Department of Behavioral Sciences seeks to train researchers, teachers and professionals in the knowledge and analytical skills of the behavioral sciences relevant to significant public health issues. The specific focal points for teaching and research are: (1) the influences of behavior on health and disease; (2) behavioral aspects of health services, including psychosocial factors affecting the utilization of services and compliance with medical regiments, as well as the behavior of health professionals; (3) behavioral pathologies including addiction to drugs and alcohol, mental illness and child abuse; and (4) social science methodologies as applied to public health problems and the evaluation of health services and programs.

Degrees

Master of Public Health with concentration in Behavioral Sciences; Master and Doctor of Science in Behavioral Sciences.

Research

The Harvard unit of the nationwide Multiple Risk Factor Intervention Trial (MRFIT) reached the halfway point in the 10-year testing of the hypothesis that mortality from coronary heart disease can be reduced by altering the risk factors of elevated blood pressure, elevated blood cholesterol and cigarette smoking. Results of intervention efforts thus far show substantial reductions in all three risk factors.

A project was begun to help teenagers to quit, or not to take up, smoking. With the aid of senior high school students to counsel junior high school students, the project began in schools in several towns in Massachusetts.

The Harvard Community Child Health Studies is a multidisciplinary research and evaluation project in three communities (Flint, Michigan, Cleveland, Ohio, and Berkshire County, Massachusetts) and designed to examine many policy-relevant issues related to the identification of child health problems as well as the design and implementation of programs and policies to meet child health needs.

An interdisciplinary evaluation of child health services within a number of communities is currently taking place. Other research interests include an assessment of the respective roles of social stratification and prenatal care as factors influencing the risk of low birthweight and infant mortality in the United States. All of these interests involve the application of structural equation models to the analysis of nonexperimental data.

Some of the courses that the Department offers are listed below. The corresponding descriptions are on p. 80.

Psychiatric Epidemiology: Problems, Concepts, and Methods; Sociological Perspectives on the Study of Health Attitudes and Behaviors; Drug Abuse; Inducing Social Change; Managing Human Resources in Health Care Settings; Methods of Social Research: Design and Measurement; Methods of Social Research: Data Collection and Analysis; Psychiatric Problems in Organizations and Industry; Change of Health Behaviors; Health and Behavior; Tutorial Programs; and Research Training. In conjunction with other departments: The American Household in Demographic Perspective and Child Development and Social Policy.

Research on medical sociology: studies on ethnic variations in response to health care, with special attention to consumer satisfaction are being undertaken. Other projects include the study of patient compliance with medical regimens and the genesis of children's health beliefs and behaviors.

Research on opiate addiction among street addicts, medical professionals and medical patients is also underway.

A research project entitled, "Support Systems, Stress and Primary Health Care," is funded by the National Center for Health Services Research. This prospective study seeks to assess the role of stress and social support systems in the utilization of primary care health services at a neighborhood health center in Boston.

Programs

Goals

Designed to train persons to perform significant research on behavioral aspects of health and health services. Students learn research skills, techniques of applying behavior sciences to public health issues, and relevant elements of behavioral disciplines.

Curriculum

Students take introductory and advanced courses in statistics, research methods, and epidemiology. Research training is also gained by participation in the faculty's research projects. Course work is done in areas of health and behavior, behavioral aspects of health services, and behavioral pathologies. (See p. 9 for specific degree requirements.)

Admission

Applicants for the doctoral program must have a baccalaureate degree and preferably an advanced degree in a related behavioral science discipline or medicine. These individuals are admitted directly into the doctoral program. Applicants for the master of science program should have a doctoral degree.

Career Outlook

Recent graduates have taken research and teaching positions in major health institutions and academic settings.

Department of Biostatistics

C. Frederick Mosteller, S.B., S.M., A.M., Ph.D., S.D. (hon.), Roger Irving Lee
Professor of Mathematical Statistics and Head of the Department

Faculty

Professors Miettinen, Reed and Zelen; Associate Professors Drolette, Louis, Lagakos, and Pagano; Assistant Professors Begg, Costello, Feldman, Fuhrer, Gelber, Gelman, Hanley, Laird, Lavin, MacIntyre, Mietlowski, Neff, Schoenfeld, Stanley, Thibodeau, and Waternaux; Lecturers Bailar and Kent

Teaching and Research Staff

Research Associate Lew

Introduction

The Biostatistics program is designed to prepare students for careers in the application of statistical and mathematical methods to the design and analysis of health research studies, and to the planning and evaluation of health services programs. Twenty-five faculty participate in this program, which includes training in research, collaboration, and teaching. The graduate program offers four advanced degrees — three Master of Science degrees and the Doctor of Science degree.

Degrees

Master and Doctor of Science in Biostatistics; Joint Department Master of Science.

Research

As part of the advanced degree program, all students work with faculty on ongoing projects in methodological research activities and scientific collaborations. In the area of methodological interests, faculty conduct research in data analysis, biometry, experimental design, multivariate methods, stochastic processes, pattern analysis, statistical computing, data base management, computer science, health policy, and cost-benefit analysis. In the area of collaboration, personnel are engaged in coordination of national clinical trials, FDA investigations, studies of institutional variation in burn patients, design of dental health surveys, environmental health, analysis of childhood growth patterns, in addition to projects in the Department Consulting Service. The Department also conducts a surgery study group and seminar series.

Programs

The majority of candidates are enrolled in Master of Science programs.

Goals

All the degree programs will train students in the following areas: (1) the use of numerical data as a basis for drawing conclusions and development of logical plans based on these conclusions; (2) the use of statistical methods in formulating problems, planning studies, conducting analyses, writing reports; and (3) the development of skills needed to collaborate and communicate effectively with scientists in related disciplines.

The doctoral program has the following additional objectives: (1) the development of statisticians capable of conducting independent methodologic research; and (2) the training of statisticians capable of providing scientific leadership.

The courses offered by the Department of Biostatistics are designed to meet three specific needs.

First, it is essential for workers in all branches of public health to be able to draw conclusions from numerical data and to base logical action on these conclusions. This applies to the administrator who must evaluate problems and the results of his or her activities, as well as to the epidemiologist and the research worker who must apply statistical techniques to their laboratory and field problems. The course Biostatistics 101a,b is designed to give a basic command of simple methodology to all students, an appreciation of the value of the method, and an awareness of the frequent abuse encountered in the health literature.

Second, field and laboratory researchers must be able to use statistical methods in planning and analyzing their experiments. Some elective courses are designed to provide an introduction to methodology in this area. These courses are adapted to the needs of students of this School, many of whom have broad backgrounds in biological sciences while few have extensive preparation in mathematics. A minimum of mathematical exposition is therefore included in some courses intended for students in these categories. Other electives go into greater depth in particular topics. In all electives, the emphasis is on understanding the underlying assumptions inherent in standard statistical procedures and on the ability to determine when such procedures are appropriate.

Third, there is the group of students conducting graduate work in biostatistics. To meet the needs of these students, the Department offers courses coordinated with the Department of Statistics at Harvard and the Department of Mathematics at Massachusetts Institute of Technology. Specialized courses are given in data analysis, biometry, experimental design, multivariate methods, stochastic processes, statistical computing, data base management, and computer science.

Curriculum

Two-Year Master of Science

This program is intended for candidates with no prior graduate degree. Candidates should have had two semesters of calculus and one semester of linear algebra. Each student must spend two academic years in residence and complete courses totaling a minimum of 80 credit units. At least 40 credit units must be taken in approved statistics and epidemiology courses. The remaining credit units may be electives in the basic health sciences. Training shall include practical experience in teaching, data analysis, and computing.

One-Year Master of Science

This program is directed towards those students with a previous graduate degree in a medical, scientific or statistical field. Candidates should have had two semesters of calculus and one semester of linear algebra. Each student must spend one academic year in residence and complete courses totaling a minimum of 40 credit units. At least 32 credit units must be taken in approved statistics and epidemiology courses. Training shall include practical experience in data analysis and computing.

Joint Department Master of Science

This program is directed towards those students seeking a Master of Science from two departments within the School of Public Health. Candidates should have had two semesters of calculus and one semester of linear algebra. Students must take at least 32 credit units in biostatistics and epidemiology to satisfy the Department of Biostatistics requirements, with remaining credit units allocated to satisfying the S.M. degree requirements for the other department. Training shall include practical experience in data analysis and computing.

Doctor of Science

This program is designed for students seeking a doctoral degree. Candidates are required to have had two years of calculus and one semester of linear algebra and must submit Graduate Record Examination Aptitude test scores. Students with particularly strong backgrounds may be admitted directly to this program, while other students may be admitted subsequently, pending satisfactory completion of the Master of Science program. Each student must spend two academic years in residence and complete courses totaling a minimum of 80 credit units. Training shall include practical experience in teaching, data analysis, and computing. Any work completed at the School of Public Health towards a Master of Science degree may be applied to the Doctor of Science degree.

Further requirements include: (1) completion of a major in biostatistics (40 credit units) and a minor in mathematical statistics; (2) completion of a second minor (10 credit units) in a health-related area; (3) completion of a two-part qualifying examination; and (4) completion of a doctoral thesis.

Admission

Please see specific degree requirements on p. 13.

Career Outlook

The career outlook for biostatisticians is very promising. Biostatistics graduates have secured positions in government, universities, industry, and public health centers. Statisticians are needed in the broadly defined areas of medical care, drug therapy, health maintenance, environmental control, and health care administration. The 1978 report on professional employment needs, issued by the National Academy of Science, indicated a critical shortage of biostatisticians and epidemiologists with graduate degrees. This report also noted that shortages were likely to continue for the next five years.

Some of the courses that the Department offers are listed below. The corresponding descriptions are on p. 81.

Principles of Biostatistics; Statistical Methods in Research; Mathematical Foundations of Biostatistics; Survey Research Methods in Community Health; Advanced Topics in Biostatistics; Discrete Multivariate Analysis; Computing Principles and Methods; Multivariate Analysis for Quantitative Data; Design of Experiments; Data Analysis; Theory of Biometry I; Theory of Biometry II; Regression and Analysis of Variance; Stochastic Processes in Medicine and Biology; Computer Programming; Introduction to Computing; Statistical Computing; Applied Data Management; Tutorial Programs, and Research.

Courses offered in conjunction with other departments are listed below.

Principles of Epidemiology I: Elements of Study Design and Data Analysis; Principles of Epidemiology II: Problem Conceptualization and Study Design; Principles of Epidemiology III: Data Analysis and Inference; Practice of Epidemiology; Health Program Evaluation; Statistical Methods for Health Policy and Management; Analysis of Health and Medical Practices.

Department of Environmental Health Sciences

Dade W. Moeller, S.B., S.M., Ph.D., A.M. (hon.), Professor of Engineering in Environmental Health and Head of the Department

Faculty

Professor First; Associate Professors Burgess and Dennis; Assistant Professors Cooper, Hinds, Keyserling, D. H. Leith, Smith, and Spengler; Lecturers Bjarngard, Cudworth, Judy, Shapiro, and Webster

Teaching and Research Staff

Lecturers and Visiting Lecturers Anderson, Billings, Bracken, Jaeger, Mahoney, Nelson, Selby, Svensson, Viles, and Zimmerman; Research Associate Wolfson

Introduction

With growing public awareness of the need for environmental pollution control and worker protection, increasing attention is being focused on these problems at all levels of our society. There are five specialized programs offered by the Department of Environmental Health Sciences. Although an occasional student is admitted to a general program in environmental health sciences, for which courses may be planned to suit individual student interests and career goals, the majority of the students elect one of the specialties listed below. In addition to specialized courses, graduate education in each of these fields includes courses on human physiology, epidemiology, and biostatistics.

Degrees

Master and Doctor of Science in Environmental Health Sciences. Generally, students who enter the program immediately after completing the baccalaureate degree enroll in the Master of Science program. Upon completion of the Master of Science program, they may continue for a doctoral degree.

Requirements

Problem analyses and the evaluation and reporting of such analyses are expected to be major components of the work of health professionals who graduate from these programs. To assure the development of these skills, each student accepted into a two-year master's program will be required to conduct an appropriate research or related study and to present a written report on it at an acceptable professional level. Such studies and the associated reports will generally be completed during the second year of the program. The minimum time devoted to this effort will be five credit units per semester, for a total of ten credit units.

Please see p. 13 for specific degree requirements.

Research

Supporting the teaching program are extensive research activities. Current studies include the evaluation of the exposures of workers to air contaminants, development of improved engineering controls for exposures to

toxic materials, assessment of the environmental impact of nuclear facilities, medical radiation applications and dosimetry, the design of cleanup systems for radioactive sodium aerosols, the application of gas- and liquid-phase reactions to particulate and gas removal, a numerical study of urban scale atmospheric transport, and an investigation of the population dose from radiation of natural origin. Supporting these studies are related cooperative research projects conducted by the Departments of Physiology and Epidemiology. As a result, students have many excellent opportunities for research, either on an independent basis or as a participant in an ongoing project.

Programs

Air Pollution Control

Goals

To provide preparation in the sciences basic to understanding air pollution research and control activities.

Curriculum

Generally includes courses in community air pollution, meteorological aspects of air pollution, identification and measurement of air contaminants, air and gas cleaning, and aerosol technology.

Admission

Acceptable candidates for the program normally have a bachelor's degree in engineering, chemistry, mathematics, biology, or physics. Although the S.M. degree usually requires two years to complete, students with prior master's degrees and with training or experience in related areas, may be able to complete the program in one year. Some students continue toward the Doctor of Science degree.

Career Outlook

Recent graduates have taken positions with federal, state, or local regulatory agencies, with consulting firms, with industry, or with universities.

Industrial Hygiene

Goals

The master's program is designed to meet the demand for professional personnel with the skills and scientific knowledge that are needed to identify and control health stresses associated with the working environment — e.g., air contamination, noise, radiation, heat, pressure, etc.

Curriculum

Generally includes recommended and required courses dealing with basic problems in occupational health and industrial environments, policy issues in occupational health, environmental control, identification and measurement of air contaminants, air and gas cleaning, principles of toxicology, human factors in occupational performance and safety, and aerosol technology.

Admission

Acceptable candidates for the program normally have a bachelor's degree in engineering, chemistry, physics, or biology. Although this is primarily a two-year program, students with master's degrees in the above disciplines and some students with prior training or experience in related areas may be able to earn the S.M. degree in one year. It is a terminal program for most students, although a few continue toward the Doctor of Science degree.

Career Outlook

Recent graduates have taken positions with federal, state, or local regulatory agencies, with consulting firms, with industry, or with universities.

Environmental Health Management**Goals**

To train professional public health personnel to manage environmental health problems, particularly in urban areas.

Curriculum

Multidisciplinary program which draws upon courses offered by the Harvard School of Public Health, by other faculties of Harvard University, and by the Massachusetts Institute of Technology. In addition to the basic course in environmental health management, students normally take a series of courses in air pollution control, industrial hygiene, radiological health (specialty areas offered through the Department of Environmental Health Sciences), or water pollution control (offered through the Division of Applied Sciences of the Graduate School of Arts and Sciences), supplemented by electives in environmental economics, public health administration, political and social sciences, environmental law, environmental planning, and health education.

Admission

Students admitted to the program normally hold a bachelor's degree in biology, engineering, geology, or another science. This program is usually two years in length and generally includes a field training assignment with an environmental health agency during the summer. Selected opportunities for continuing toward the doctoral degree are open to qualified recipients of the S.M. degree.

Career Outlook

Recent graduates have taken administrative or regulatory positions in environmental health.

Medical Radiological Physics**Goals**

To provide students with a large portion of the knowledge and experience necessary for the practice of radiological physics in a hospital and for certification by the American Board of Radiology.

Curriculum

The program utilizes the resources of the Harvard teaching hospitals in collaboration with the recently established Harvard-M.I.T. Program in Health Sciences and Technology. The curriculum draws upon courses within that program as well as courses offered within the Harvard School of Public Health. A typical curriculum includes recommended and/or required courses in radiation protection, radiation biology, X-ray protection, and physics in diagnostic radiology, nuclear medicine, and radiation therapy.

Admission

Program trainees normally have prior bachelor's or master's degrees in physics and mathematics. Most students are able to earn the S.M. degree in two years. Approximately half of the graduates continue toward the doctoral degree.

Career Outlook

Recent graduates have taken positions principally as radiological physicists either in health-care settings or in research.

Radiological Health (Radiation Protection)

Goals

To provide students with knowledge of the fundamentals of radiation protection. Considerable attention is given to the effects of environmental releases of radioactive materials, and the associated requirements for complying with regulations and standards.

Curriculum

Includes recommended and required courses covering radiation protection, radiation biology, X-ray protection, aerosol technology, and radiation dosimetry.

Admission

Students admitted to the program normally have bachelor's or master's degrees in physics, mathematics, or engineering. Two years are normally required to earn the S.M. degree, although some students with prior training and/or experience in relevant areas may earn the degree in one year. About half the students continue toward the doctoral degree.

Career Outlook

Recent graduates have taken positions with the nuclear power industry, hospitals, universities, research institutions, governmental regulatory agencies, and consulting architectural or engineering firms.

Some of the courses that the Department offers are listed below. The corresponding descriptions are on p. 83.

Environmental Health Interdepartmental Courses

Principles of Environmental Health; Human Factors in Occupational Performance and Safety; Current Topics in Occupational Health and Safety; Occupational Medical Clinics; Policy Issues in Occupational Health; Mathematical Modeling for Health Sciences; Critical Review of the Scientific Basis for Occupational Standards; Basic Problems in Occupational Health and Industrial Environments; Introduction to Industrial Hygiene; and Field Work.

Environmental Health Science

Departmental Seminars; Introduction to Environmental Health Management; Environmental Control: Industrial Ventilation; Noise and Vibration Control; Aerosol Technology; Community Air Pollution; Meteorological Aspects of Air Pollution; Identification and Measurement of Air Contaminants; Air and Gas Cleaning; Introduction to Radiation Protection; Introduction to Radiation Instrumentation; Advanced Topics in Radiation Protection; X-ray Protection; Introduction to Physics of Diagnostic Radiology; Introduction to Physics of Nuclear Medicine; Introduction to Physics of Radiation Therapy; Physics of Diagnostic Radiology; Physics of Nuclear Medicine; Physics of Radiation Therapy; Tutorial Programs; and Research.

Department of Epidemiology

Brian MacMahon, M.B., Ch.B., D.P.H., Ph.D., S.M. in Hyg., M.D., Henry Pickering Walcott Professor of Epidemiology and Head of the Department

Faculty

Professors Cole, Hutchison, and Miettinen; Associate Professors Monson, Morrison, and Rothman; Lecturer Ellison

Teaching and Research Staff

Lecturers and Visiting Lecturers Boice, Feinleib, Jick, Miller, Paffenbarger, Peters, Sartwell, and Warram; Research Associates Buring, Finkle and Yen

Introduction

The major objective of the Department is to provide opportunities for training and experience in the application of epidemiologic research methods to the investigation of diseases of unknown etiology. Emphasis is on the cardiovascular disorders, the malignant neoplasms, abnormalities of reproduction and development, and other major diseases for which preventive measures are still unknown or inadequate.

Degrees

Master and Doctor of Science in Epidemiology; Doctor of Public Health.

Research

An international study of newly diagnosed cases of bladder cancer is investigating differences between these cases and comparison groups who do not have cancer. Factors of major interest as possible causes of bladder cancer include exposure to industrial chemicals, cigarette smoking, and use of saccharin and other non-nutritive sweeteners.

In a study of congenital heart disease, associations between 13 categories of drugs and various types of these diseases were described. Many of the associations were reported for the first time.

Study of pregnancies in nearly 20,000 women produced no evidence of an increase in risk of birth defects after oral contraceptive use except for undescended testes. In a related study, women were found to give birth to twins more frequently after oral contraceptive use.

Employment in the rubber industry is being studied as a possible factor leading to abnormalities of the fetus.

Thyroid disease is under investigation as a condition possibly associated with an unusual subsequent risk of cancer.

A recently completed study showed a sharply increased risk of breast cancer in young women who had received radiation to the breasts during teen and young adult ages. An expanded study is now investigating this hazard in greater depth.

A clinical trial is being started to evaluate three methods of treatment of infants with respiratory distress syndrome and patent ductus arteriosus.

A series of studies of Hodgkin's disease are investigating disease clusters, familial patterns, associated viral infections, effect of radiotherapy in disease management, and late development of leukemia as a complication of radiotherapy or chemotherapy of Hodgkin's disease.

Programs

Goals

The master's program is intended to provide students with basic skills in epidemiologic and quantitative methods and in computing, in preparation for research careers. The doctoral programs are designed for persons who plan careers of research or teaching in epidemiology.

Curriculum

The one-year research training program for the S.M. degree includes most of the courses offered by the Department, plus courses in principles of biostatistics, statistical methods in research, and computing principles and methods (which are offered by the Department of Biostatistics), a total of 25 to 30 credit units. Additional formal courses in areas of special interest and/or supervised research comprise the remainder of the program. The S.D. program is of four to five years' duration for persons holding baccalaureate degrees; for persons holding relevant master or doctoral degrees, however, the program is shorter, usually two to three years in length. Unless course work equivalent to that described above for the S.M. degree has been taken previously, most of the first two years of a doctoral program is occupied with courses. Subsequently, completion of a thesis and experience as a teaching assistant are the principal components. The content of the Dr.P.H. program is identical to that of the S.D. program and will vary in length, usually from two to five years, depending on the individual's background and progress with the thesis component. (Please see p. 11 for more specific degree requirements.)

Residency

A three-year residency in the Department has been approved as satisfying residency requirements of the American Board of Preventive Medicine for certification in General Preventive Medicine. Requirements of the approved residency and of the School's degree programs may be satisfied simultaneously. The residency does not satisfy the one-year clinical component required by the American Board of Preventive Medicine.

Admission

Acceptable candidates for the S.M. program are physicians, veterinarians, and dentists. For qualified students the period of research training may be extended by admission to either of the doctoral programs offered by the School, or by admission to special student status. Most of the training beyond the master's degree is occupied in supervised research experience. Potential doctoral candidates must plan at least two years in residence beyond completion of the master's degree. For most students in the program, the S.M. degree is considered terminal. The Department considers applications for direct admission to doctoral candidacy (S.D. degree) from persons holding baccalaureate degrees with strong backgrounds in biology and mathematics; it also encourages candidates holding other master and doctoral degrees.

The Dr.P.H. program is available to persons holding the M.P.H. degree.

Some of the courses that the Department offers are listed below. The corresponding descriptions are on p. 88. Introduction to Epidemiology; Seminars; Topics in the Theory of Epidemiology; Epidemiology of Chronic Disease; Environmental Epidemiology; Tutorial Programs; Research.

Some of the courses the Department shares with Biostatistics:

Principles of Epidemiology I: Elements of Study Design and Data Analysis; Principles of Epidemiology II: Problem Conceptualization and Study Design; Principles of Epidemiology III: Data Analysis and Inference; and Practice of Epidemiology.

Career Outlook

Some of the positions recent graduates have taken: Officer in Epidemiology Intelligence Service, Center for Disease Control; epidemiologists at the National Cancer Institute and Bureau of Radiation Health; hospital physicians; statisticians; appointments at universities and medical schools in research and instruction, and director of education of a research and teaching clinic.

Department of Health Policy and Management

Members of the Executive Committee

William J. Curran, J.D., LL.M., S.M. in Hyg., Frances Glessner Lee Professor of Legal Medicine in the Faculty of Medicine and the Faculty of Public Health; Howard S. Frazier, M.D., Ph.B.; Marc J. Roberts, Ph.D., Professor of Political Economy; and Alonzo S. Yerby, M.D., M.P.H., Professor of Health Services Administration

Faculty

Professors Haggerty, Reed, and Rosenkrantz; Associate Professors Fineberg, Hsiao, Nesson, Sheldon, and Stason; Assistant Professors Feldman, Fuhrer, Hemenway, Palmer, Taylor, Thompson, and Young; Lecturers Braun, Chase, Kasten, Rosenberg, Segall, Sherman, Strong, Trevelyan, and Yacovone

Teaching and Research Staff

Lecturers and Visiting Lecturers Allen, Bander, Beraducci, Bishoff, Blumenthal, Burchfield, Bycoff, Cloherty, Cohen, Cotton, Crampton, Cupples, Densen, Douglass, Dull, Field, Holden, Johnson, Keith, Komaroff, Landy, Levine, Liang, Lorch, Meehan, Morris, Newberger, Nighswander, Pyle, Rosenthal, Ryan, Sands, Schaufler, Shapiro, Shepard, Simon, Smith, Stranova, Wathne, Winsten, and Zanditon; Instructors Avorn, Barrett, Berwick, and Dumbaugh; Research Associates Ikels and Thomas; Consultants Janeway and Livernash

Introduction

The Department includes the Division of Health Services Administration. The Health Policy and Management program is an interdisciplinary one which prepares students for careers in health planning and regulation or in the administration of health programs and institutions.

Degree

Master of Science in Health Policy and Management.

Program

Curriculum

A set of required core courses comprise the first year of each student's two-year program. These core courses provide the basic analytic skills and knowledge, needed by professionals serving in both policy and management roles in the health field. Subjects covered include: health care issues and institutions, epidemiology, biostatistics, financial management, organizational behavior, management control, economics of health care institutions and the health care system, political and bureaucratic analysis of health care, quantitative methods and sociological and historical perspectives of health. Students may be exempted from those core requirements in which they demonstrate prior proficiency.

In the second year, each student's program of study concentrates on one of two primary skill areas (either policy or management) and in a single,

substantive health area (such as health services, nutrition, environment or population). Diverse course offerings allow students to develop expertise in their primary area of concentration. As part of their second year seminar, each student prepares a paper which analyzes a specific problem within the selected substantive health area.

Students are eligible to select appropriate advanced courses offered by other Harvard faculties including the Business School, the John F. Kennedy School of Government, Arts and Sciences, and the Massachusetts Institute of Technology. The large number of available courses, both at the School of Public Health and the other schools, provides an opportunity to pursue special interests.

Field Work Experience

The program is based on the strongly held view that training in an academic setting must be complemented by experience in real world, problem-solving situations. To this end, a required summer internship experience between the first and second years has been designed. Agencies, institutions or programs involved in health care offer two-month experiences for students. During their second year, students participate in a required applied research seminar which provides expanded opportunities for field work exposure. The seminar allows students to continue their association with summer preceptors or to gain new and different professional exposure.

Both the Summer Internship and the Applied Research Seminar are designed to be closely related to the student's ultimate career objectives.

Admission

The program seeks candidates whose academic record, personal characteristics and work experience suggest intellectual competence and outstanding potential in the areas of health policy and management. All applicants must demonstrate through course work and aptitude test performance the ability to master the quantitative and analytic content of the program. Academic backgrounds in either the natural or social sciences are equally acceptable. Applications from candidates who have at least one year of pertinent post baccalaureate work experience in the health field and or other graduate or professional training are considered to be most competitive for admission. (Please see specific degree requirements on p. 13)

Career Outlook

Some of the positions recent graduates have taken: director of a community hospital; consultant in a management consulting firm; planner in HEW; director of finance and development in a large group practice; planner in a Blue Cross Plan; health educator in a community hospital; director of support services in a regional hospital overseas; administrative director of a primary care center; director of a certificate of need program; director of a state commission on the handicapped; assistant administrator of an extended care facility; analyst in a state regulatory agency; nutrition educator in a school system; and planner in a health system agency.

Division of Health Services Administration

Introduction

The increasing complexity of medical services calls for diverse types of health organizations. The growth of organized health services has created an increased need for qualified administrators and researchers. A major goal of the Division is to provide education for leadership in health service organizations. Emphasis is placed on planning, organization, evaluation, and regulation of health services.

Cross-national studies of health care systems are used as analytic tools to assist the student in gaining an appreciation of the universal nature of the determinants that govern organized activity for the delivery of health services.

Consideration is given to traditional administrative techniques as well as more recently developed quantitative and analytic methods. Since many problems, broad in scope, must be studied, the resources of multiple disciplines and several Harvard faculties are available for the student.

Degrees

Master and Doctor of Public Health; Master and Doctor of Science in Health Services Administration.

Program

Goals

The Program in Health Services Administration is designed for health professionals and for professionals in other disciplines which are relevant to the activities of planning, organization, management, evaluation or regulation of health services. Most of the students admitted to the program hold professional degrees in medicine, dentistry, law, nursing, social work or psychology. Based on their prior experiences, the graduates of the program tend to combine the practice of their disciplines with the managerial role.

Curriculum

The curriculum of the program is designed with sufficient flexibility to permit a student to direct his or her studies to particular health areas. Courses offered by the Division normally constitute a substantial portion of each student's program.

Admission

A one-year program is offered which leads to the degree of Master of Science in Health Services Administration.

Admission requirements vary somewhat depending on whether the student intends to continue for the S.D. degree. Students who seek admission to the S.M. program but who do not intend to pursue doctoral study generally must hold a medical or dental degree or a master's or doctoral degree in disciplines related to health or administration, and preferably have had relevant work experience. Students without previous advanced

Some of the courses that the Department and the Division offers are listed below. The corresponding descriptions are on p. 89.

Economic Analysis; Health Economics; Economic Analysis for Public Health; Health Care Issues and Institutions; Administrative Systems; Health and Social Welfare Systems in Cross-National Perspective; Government and Private Funding for Research and Health Care Programs; Quantitative Policy Analysis; Introduction to Operations Research; Dental Public Health Practice; Dentistry and Social Policy; Health Planning in Developing Countries; Planning in the Hospital Setting; Economics of Health Planning; Health Care Operations Management; Administration of Personal Health Service Programs; Personnel and Labor Relations; Quality Assurance in Health Services; Design and Implementation of Health Care Regulation; Reimbursement Systems; Decision Analysis and Evaluation; Issues in Geriatric Health Care; Ethics and Geriatric Policy; Human Rights in Health; Seminar in Economics for Health Policy Analysis; Applied Research Seminar; and Tutorial Programs.

In conjunction with other departments:

Statistical Methods for Health Policy and Management; Health Program Evaluation; Health Planning in Developing Countries; The Design and Management of Population Programs; and Analysis of Health and Medical Practices.

degrees in a health field may be admitted to the S.M. program provided that they intend to continue for the S.D. degree. In some cases, such students may be admitted directly as provisional doctoral candidates and may take the doctoral qualifying examinations after adequate course work without taking the S.M. degree.

Students who lack a previous health-related advanced degree and who do not wish to pursue doctoral study should generally apply for the two-year program in health policy and management. (Please see specific degree requirements on p. 9.)

Career Outlook

Some positions recent graduates have taken: state commissioner of health, director of metropolitan family life center, regional director of medical research and education; associate general counsel, HEW; city health commissioner; deputy director of the Center for Disease Control, USPHS; assistant to the director of the National Center for Health Services Research; director of planning in Ministry of Health, Ghana; group manager, office of technology assessment for the U.S. Congress.

Department of Maternal and Child Health and Aging

Isabelle Valadian, M.D., M.P.H., Professor of Maternal and Child Health and Head of the Department

Faculty

Professors Curran, Reed, and Yerby; Assistant Professors Deykin, Walker, and Weitzman; Lecturers Dwyer and Wray

Teaching and Research Staff

Lecturers and Visiting Lecturers DeLollis, Gold, Hargreaves, Messenger, and Stubblefield; Research Associate Butler

Introduction

The Department of Maternal and Child Health and Aging is concerned with providing a comprehensive study of the human life cycle and the factors which affect individuals' life-long health status.

Degrees

Master and Doctor of Public Health; Master and Doctor of Science in Maternal and Child Health.

Programs

Goals/Curriculum

The major objective of the Department is to provide in-depth understanding of the physical, social, and psychological determinants of health at various stages of the human life cycle and to promote practical application of this knowledge. Specifically, the curriculum emphasizes:

1. the developing individual and his or her changing physical, psychological, social, and cognitive strengths from conception to senescence within the context of family and community;
2. the examination of those health, welfare and related services which are currently available and those which could be instituted to meet the health needs of individuals, including those with chronic illness, handicapping or other special conditions;
3. the roles of governmental bodies, health agencies, voluntary and consumer groups in the organization and delivery of health and social services at all levels, e.g., international, national, state and local; and
4. the interface of the law with health and related systems which has varied implications for service and research at different stages of life.

Admission

The curriculum prepares professionals from health disciplines (including medicine, dentistry, nursing, social work, nutrition, psychology, health education) and other related areas such as law, education, and anthropology to assume responsibility for advocating and providing health care for

Some of the courses that the Department offers are listed below. The corresponding descriptions are on p. 92.

Child Growth and Development; Child Growth and Development II: Advanced Seminar; Primary Maternal and Child Health Care; Content of Maternal and Child Health Services; Programs and Issues in Maternal and Child Health Services; Research Approach to Growth, Development and Health of the Child; Maternal and Child Health in Developing Countries; Nutrition in Child Growth and Development; Rural Health Services; Social Services for Mothers and Children; An Introduction to Personality and Cognitive Development; Health Care of Women; Tutorial Programs; Field Study; Research.

In conjunction with other departments:

Child Development and Social Policy and Human Rights in Health.

mothers, children, youth, adults, and the aged.

Please see p. 9 for more specific degree requirements.

A limited number of fellowships may be available for master's candidates concentrating in the area of maternal and child health.

Career Outlook

The master's degree prepares candidates for positions where they will be instrumental in initiating and reshaping public health practice at federal, state, and local levels. In addition, the doctoral program trains researchers and prepares professionals for academic positions.

Department of Microbiology

M. E. Essex, D.V.M., Ph.D., Professor of Microbiology and Head of the Department
Faculty

Professor Nichols; Associate Professors Cerny and Vinson; Assistant Professors Eisenstadt, Grant, Haseltine, and Herrmann; Lecturers Madoff and Modabber

Teaching and Research Staff

Visiting Lecturers Fiumara, Gilfillan, Grady, MacDonald and Wright; Instructor M. Benfari; Research Associates Cotter, Girard and Greenberger

Introduction

The Department of Microbiology is primarily involved with the biology, epidemiology, and immunology of infectious disease agents, especially viruses. Training programs leading to the Doctor of Science degree are emphasized but the Department also participates in the professional degree programs offered by the School, for those so interested. Doctoral training areas include basic and applied research in virology, immunology, cancer biology and medical microbiology.

A collegial atmosphere prevails among faculty and students, and students are encouraged to participate in the numerous seminar series and informal discussion groups the Harvard Medical Area has to offer. Course-work is available in several areas of microbiology, in biochemistry and cell biology at the Harvard Medical School, other schools within Harvard University, or at the Massachusetts Institute of Technology, in addition to the offerings of the Department and the School.

The Department also maintains a relationship with the Massachusetts State Laboratory Institute, and is involved in joint research efforts with some of our associates at that Institute. In addition to the above research programs, the Department is involved in the teaching of public health policy and planning, especially as it relates to infectious disease. A research degree program in this area is not currently available, but is being planned for the future.

Degree

Doctor of Science in Microbiology, with specialization in a particular area. There are no programs leading to the Master of Science in Microbiology as the terminal degree.

Research

Some of the areas in which Department faculty are conducting research are: cellular and tumor immunology, cancer biology and epidemiology; immunodiagnosis, immunochemistry and biochemistry of respiratory and enteric viruses, environmental aspects of virology, and mutagenesis.

Some of the courses that the Department offers are listed below. The corresponding descriptions are on p. 94. Case Studies in Public Health Planning and Decision Making; Critiques of Current Literature on Infectious Diseases; Clinical Problems in Infectious Diseases; Laboratory and Immunologic Aspects of Infectious Diseases; Departmental Seminar; Intracellular Microorganisms Pathogenic for Man; Case Studies in the Epidemiology of Infectious Disease; Sexually Transmitted Diseases; Virology; The Molecular Biology of Cancer; Tutorial Programs; and Research.

Program

Goals

To provide training in research leading to a doctoral degree in microbiology, with specialization in a particular area.

Curriculum

At the doctoral level, major emphasis is placed on research training in immunology, virology, cancer biology, and medical microbiology. Students are encouraged to develop strengths in related areas such as molecular biology and epidemiology.

During the first two years students take courses as required to establish a firm background in the appropriate areas. By the second year at the latest, the student should be introduced to laboratory research, and should be formulating a thesis proposal for evaluation. Each student is expected to demonstrate a proficiency in laboratory techniques and an ability to reason through a research problem before undertaking doctoral research. These skills can be obtained by participation in laboratory courses and laboratory tutorials, as well as departmental and interdepartmental student and faculty seminars. Faculty research collaboration is underway with several laboratories outside the Department, and student participation in these programs is also encouraged.

Doctoral students should select a specific research topic in one of the areas mentioned under *Research* soon after admission to the program. (See p. 13 for specific degree requirements.)

Admission

Prospective students should have a strong background in biology and chemistry. Previous training in microbiology, virology, and/or immunology is desirable but not necessary. Students are admitted who have a baccalaureate degree as well as those with graduate degrees.

Career Outlook

Our recent graduates have accepted research and/or teaching positions with public and private academic institutions, with governmental agencies such as National Institutes of Health and the Center for Disease Control and occasionally with private industry.

Department of Nutrition

Robert P. Geyer, S.B., S.M., Ph.D., Professor of Nutrition and Head of the Department

Faculty

Professors Bloch, Hegsted, Lown, Stare, and Timmer; Associate Professors Antoniadis, Hayes, and Herrera-Acena; Assistant Professors el Lozy, Mora, Thenen, Verrier, and Witschi; Lecturers Austin and Huber

Teaching and Research Staff

Visiting Lecturers Gershoff and Samonds; Lecturer Nicolosi; Research Associates Ausman, Chu, DeSilva, Goldberger, Gallina, Graboyes, Lew, Lynch, Rimmell, and Whelan; Consultants Cannon and McGandy; Assistants Bruno, Duffett, and Gallagher

Introduction

The Department is concerned with training and research in the basic and applied areas of the science of nutrition with orientation towards problems of contemporary public health importance, including cardiovascular disease, obesity, and diabetes. Other areas of nutrition concerning policy, planning, and applied interventions have been a long-standing interest of the Department, as have health problems related to nutrition in this country and in Central and South America, Africa, and Asia.

Degrees

Master and Doctor of Public Health with concentration in Nutrition; Doctor of Science in Nutrition; Joint Department Master of Science; Joint Department Doctor of Science.

Research

The research of the Department involves various aspects of nutrition ranging from cell biology and metabolism to animal pathophysiology, clinical studies, and policy planning at domestic or international levels. At the molecular level are studies on the regulation of cell growth by hormonal growth factors obtained from human blood components, and the synthesis and application of perfluorocarbons for blood replacement. Mechanisms of nutritional interactions with experimental obesity and effects of diet on lipoprotein metabolism, atherogenesis and diabetes are examples of nutritional biochemistry and pathophysiology studies in progress.

Extensive use is made of computers both in the mathematical modeling of growth and in interactive dietary analysis and counseling. Other areas of applied research include evaluation of nutrition programs and dietary methodology.

At the international level are projects concerning the effects of malnutrition on mortality, morbidity, mental and physical development, and the development of a methodology for assessing the impact of food price policy on protein-calorie intake by various income classes. Research activities of the faculty are listed under the course number "NUT 350-365."

Programs

Goals

For students choosing to combine the study of health policy and management with nutrition, the Department through the joint terminal Master of Science in Nutrition and Health Policy and Management degree program helps students learn to deal effectively with the many nutrition-related problems that are arising on both local and national levels.

The Doctor of Science in Nutrition degree program is designed to train highly qualified individuals interested in laboratory-oriented approaches to solving nutrition and metabolic problems. By utilizing a number of scientific disciplines and engaging in appropriate research, students learn and use the latest techniques in biochemistry, physiology, and related fields. The research, whether basic or applied, is relevant to human health. The joint Doctor of Science program between the Departments of Nutrition and Epidemiology furnishes thorough training in both of these disciplines, enabling graduates to apply sound epidemiological methods to an ever increasing number of important nutritional problems. Applicants interested in earning the Doctor of Public Health degree in an area dealing with nutrition should contact the department for information. A program combining nutrition and toxicology is now being planned. Interested persons should communicate directly with the Head of the Department of Nutrition.

Curriculum

Students in the M.P.H. program who concentrate in Nutrition are required to take Principles of Nutrition (NUT 201a,b), Departmental Seminars (NUT 204a,b,c,d) and at least one other course offered by the Department.

Students in the terminal S.M. program must complete the degree requirements in both the Nutrition and the Health Policy and Management programs. The required courses for the Nutrition component of this joint degree are Principles of Nutrition (NUT 201a,b), Nutrition Policy Formation and Program Operation (NUT 203c,d), Departmental Seminars (NUT 204a,b,c,d), Biochemistry and Physiology of Nutrition (NUT 205c,d), and a course in biochemistry. (Please see p. 13 for specific degree requirements.)

For the S.D. in Nutrition degree, students are required to take graduate level courses in biochemistry, physiology, epidemiology, and biostatistics in addition to the following Nutrition courses: Principles of Nutrition (NUT 201a,b), Nutrition Policy Formation and Program Operation (NUT 203c,d), Departmental Seminars (NUT 204a,b,c,d), Biochemistry and Physiology of Nutrition (NUT 205c,d), and Laboratory and Animal Research Techniques (NUT 206c,d). Electives pertinent to the student's interests and the doctoral program's requirements are also taken. Tutorial research is begun during the first year, and a thesis must be completed within the period prescribed by the School (see p. 16).

The requirements for the Dr.P.H. degree are the same as those given for the S.D. in Nutrition degree, but the candidate must hold a M.P.H. degree.

The joint S.D. degree in Nutrition and in Epidemiology requires the student to take the courses designated for the Doctor of Science programs in the respective departments. In addition to these courses, a minor field must also be selected that satisfies both departments. A satisfactory thesis dealing with nutrition and epidemiology must be submitted within the time limit set by the School.

Admission

Admission to the terminal S.M. degree program is the joint responsibility of the Departments of Nutrition and Health Policy and Management. Acceptable candidates must have a distinguished bachelor's degree with significant biological background. This joint master's degree requires two full years of study.

The laboratory-oriented S.D. in Nutrition degree program may be entered at either the master's or the doctoral level. It is highly recommended that the latter route be selected even by students with only a bachelor's degree. The Department may in certain instances exercise its own determination as to which option should apply. An excellent background in chemistry, biology, nutrition, or some other relevant science discipline is necessary for admission. Admission to the joint nutrition and epidemiology S.D. degree program requires a strong background in biology and mathematics. Approval by both the Departments of Nutrition and Epidemiology is necessary. Applicants interested in this program should contact the Head of the Department of Nutrition before formally applying. Applicants for the Doctor of Public Health degree with emphasis in nutrition should communicate with the Department Head prior to filing an application.

Career Outlook

Some positions recent graduates have taken: food aid administrator in Gambia; local health clinic administrator; director of nutrition support service in a medical center; assistant professor of nutrition at a school of medicine; nutritionist for federal nutrition evaluation agency; nutrition educator for national Tunisian institute; community nutritionist for state health project; food analytical chemist for industrial firm; postdoctoral research fellowships in medical centers and universities; nutritionist at a school of public health; and assistant professor of biochemistry at a university.

Some of the courses that the Department offers are listed below. The corresponding descriptions are on p. 96.

Principles of Nutrition; Nutrition Policy Formation and Program Operation; Departmental Seminars; Biochemistry and Physiology of Nutrition; Laboratory and Animal Research Techniques; Nutritional Aspects of Human Disease; Food Science and Nutrition; Nutrition Problems of Less Developed Countries; Tutorial Programs; and Research.

In conjunction with Maternal and Child Health and Aging:

Nutrition in Child Growth and Development.

Department of Physiology

James L. Whittenberger, S.B., M.D., A.M. (hon.), James Stevens Simmons Professor of Public Health, Professor of Physiology, and Head of the Department

Faculty

Professors Brain, Ferris, Hornig, Little, Mead, Peters, Roberts, and Tashjian; Associate Professors Amdur, Hoppin, D.E. Leith, Sorokin, Speizer, and Wegman; Assistant Professors Boden, Butler, Eisenstadt, H. Feldman, Fine, Kennedy, Keyserling, Rice, Richardson, Schonbrunn, Smith, and Valberg; Lecturers Murphy and Snook

Teaching and Research Staff

Lecturers R. Feldman, Levy, and Storm; Research Associates Banzett, Henson, Loring, Nagasawa, Robertson, and Voelkel; Consultant McGandy; Assistant Vetrovs

Introduction

The Department of Physiology has research and teaching activities which include physiology as a basic medical science, but which extend beyond pure physiology to encompass a broad spectrum of environmental and occupational health problems. The mechanisms of action and the adverse health effects of chemical and physical factors in occupational and community settings are typical problems that have been central to the Department's interests. Such research provides the basis for prevention and control; the problems are very complex and require the insights of many specialties. The faculty and staff of the Department reflect the multidisciplinary nature of the field and include physicians, physiologists, physicists, engineers, toxicologists, and specialists in radiobiology and occupational health. Students and research fellows come with similarly varied backgrounds.

Major objectives of the Department are to provide students with basic information on human physiology and on the relationship of human beings to their physical and chemical environment. These concepts in biology and health are examined in detail in such courses as Human Physiology, Principles of Toxicology, Radiation Biology, and Basic Problems in Occupational Health and Industrial Environments. Specific research projects of members of the Department offer students an opportunity to gain experience in research and to develop a capacity for critical evaluation of research methods.

Information concerning programs and degrees in Occupational Medicine may be found on p. 56 under *Kresge Center for Environmental Health*.

Degrees

Master and Doctor of Science in Physiology; Master and Doctor of Public Health.

Research

The research programs include topics such as: cellular effects of ionizing radiation, mechanisms of carcinogenesis and mutagenesis, inhalation toxicology, comparative respiratory physiology, the deposition and clearance

of particles in the respiratory tract, and epidemiologic studies of working populations and community populations exposed to various toxic materials. Other research areas are the mechanical properties of lungs and chest wall, development of pulmonary function tests and testing equipment, and application of these methods to the study of respiratory disease in occupational and community environments. The research and training programs in toxicology include the development and use of differentiated animal and human cell strains which perform organ-specific functions in culture as models for studies on the biochemical mechanisms of toxicant uptake and action as well as for the development of preventive or reparative interventions. Other research areas in toxicology include enzyme reaction mechanisms, mechanisms of tumor promotion, development of new analytic methodology, and behavioral toxicology.

Programs

Pulmonary Biology

Goals

This program offers doctoral training in preparation for research careers in pulmonary biology. It is built on a public health viewpoint of the lung as a portal of entry and a target organ for environmental agents, and emphasizes two aspects of organ system physiology: respiratory mechanics and respiratory defense mechanisms. The biology is broadly based, ranging from molecular and cell biology to integrated organisms, environmental, and comparative physiology; both normal and pathological physiology are included.

Curriculum

Intensive course work in the first two years may include mathematics, physics, engineering, toxicology, radiation biology, statistics, epidemiology, environmental control, pathology, and immunology. The latter part of the program consists of collaborative and independent research under the guidance of a faculty advisor. Collaborative research opportunities exist in several area institutions. (See p. 9 for specific degree requirements.)

Admission

Intended primarily for students with prior degrees in the physical sciences, or biology with a strong physical science and mathematical component. Two years of residence at the School are generally required to earn the S.M. degree; students with prior master's degrees in related areas may earn the S.M. degree in one year. Terminal master's degree programs are not ordinarily offered; students are expected to continue for the doctoral degree.

Career Outlook

Recent graduates and postdoctoral fellows have taken positions in academic, clinical, and government institutions doing basic and applied research and teaching in respiratory physiology and pathophysiology.

Radiobiology

Goals

This program is designed to offer doctoral level training in the cellular and molecular effects of radiation in preparation for research careers in radiation biology and experimental carcinogenesis.

Curriculum

Course work during the first two years emphasizes biochemistry, cellular and molecular biology, virology and genetics, as well as the preparation needed to develop the basic skills in laboratory techniques and data handling necessary for undertaking original research. The latter part of the program involves intensive laboratory research under the guidance of a faculty advisor. Some areas of ongoing research in the program include the study of: the induction of mutations and malignant transformation in mammalian cells by low and high LET radiations and by chemical agents; radiation-induced DNA damage and repair processes at the cellular and molecular levels; cytogenetic effects of radiation and chemical pollutants; and the effects of radiation in human diploid cells from cancer prone patients. (See p. 9 for specific degree requirements.)

Admission

Admission requirements include an appropriate background in biology, chemistry or physics. Although students are usually admitted into the master's program, they are expected to continue for the doctoral degree. A terminal master's program as such is not usually offered. Some students with prior master's or professional degrees, or with an unusually strong background in biology, may be admitted directly into the doctoral program.

Career Outlook

Recent graduates of the program have primarily entered academic careers as university-based independent research scientists. Several graduates have entered governmental service in the Department of Energy or the Environmental Protection Agency.

Toxicology

Goals

The research and training program in toxicology provides students with knowledge of the health implications of environmental chemicals, their interactions with a variety of cellular systems, biochemical mechanisms of cellular toxicity, the means to identify toxic environmental chemicals and to prevent or reverse adverse effects where possible.

Curriculum

The predoctoral program in toxicology is related directly to the doctoral training program of the Department of Pharmacology, a part of the Division of Medical Sciences at Harvard Medical School.

The first year is usually devoted to course work. Courses are taken within the Division, at the School of Public Health, at Harvard University in

Cambridge or at M.I.T. Students are expected to pass qualifying examinations before the end of the third semester. Thesis research to qualify for the Ph.D. degree should be completed in a total of four to five years in residence.

Admission

Students are admitted as candidates for the doctoral degree only.

Students should have knowledge of organic, physical, and biological chemistry, general biology, physics and calculus. Deficiencies might be made up in the summer before entering the program. There is no language requirement. A personal interview is strongly encouraged.

Information regarding the graduate programs in toxicology may be obtained by writing Professor Armen H. Tashjian, Jr., Laboratory of Toxicology, Harvard School of Public Health, 665 Huntington Avenue, Boston, MA 02115.

Career Outlook

Upon receipt of the doctoral degree, it is expected that most students will take a period of postdoctoral fellowship training prior to entering a career in research in an academic institution, in government or industry.

Some of the courses that the Department offers are listed below. The corresponding descriptions are on p. 98.

Human Physiology; Principles of Toxicology; Pulmonary Cell Biology; Radiation Biology; Seminar in Toxicology; Advanced Toxicology; Environmental Carcinogenesis; Structure and Function of the Mammalian Respiratory System; Tutorial Programs; and Research.

Department of Population Sciences

Nathan Keyfitz, Ph.D., Andelot Professor of Sociology in the Faculty of Arts and Sciences and of Demography in the Faculty of Public Health and Acting Head of the Department

Faculty

Professors and Visiting Professors Alonso, Dyck, Levins, Lewontin, and Salhanick; Associate Professors W. Berggren, Masnick, and Repetto; Assistant Professors G. Berggren and Ewbank; Lecturers Frisch, Wray and Wyon

Teaching and Research Staff

Lecturers and Visiting Lecturers Guerrero, Kline, D. Korten, F. Korten, McIntosh, Morehead, Plank, and Strauss; Research Associates Holtrop, Hua, Seeley, and Whipple; Consultants Gamble, Goldstein, and C. Thomas.

Introduction

Acting under the conviction that rapid population growth was thwarting efforts to provide better housing, education, nutrition, health services, and medical care, and that the disparity between rates of population increase and rates of development of human and economic resources is a crucial problem confronting society, the School of Public Health established the Department of Demography and Human Ecology in 1962 (renamed the Department of Population Sciences in 1969) and the Center for Population Studies in 1964. As the view of the role of population change in health and welfare has matured, increasing attention has been given to questions of the broader interrelations between population structure, health and welfare, and social change.

Degrees

Master and Doctor of Public Health with concentration in Population Sciences; Master and Doctor of Science in Population Sciences.

Research

Some research activities of the Department are: working toward a better understanding of the biochemical and endocrinologic mechanisms controlling ovulation; studying the long-term impact of demographic changes within the United States; examining the interactions of fertility, income distribution and other aspects of socio-economic development; pursuing research applied to aspects of family planning and the interactions of fertility, nutrition and infectious diseases; continuing studies leading to community diagnosis of causes of rates of birth, death and migrations; studying biological aspects of population programs; studies of ethical aspects of population policies and programs; analyzing voluminous data collected in field studies in Haiti, including studies of mortality, morbidity, nutrition status, fertility and impact of programs; and examining factors that might improve food production.

Programs

Goals

There is wide variability among the programs of individual candidates, reflecting the diversity of the students' background, national origins, previous education, areas of professional concern, and career goals. Given these varied curriculum needs, the overall goals of the program are to develop sophistication in data and information management and evaluation, as well as to provide a broad philosophical perspective on problems and issues in the population field and on related issues of health and health care.

Curriculum

Faculty affiliated with the Department are specialists in demography, ethics, epidemiology, economics, sociology, ecology, genetics, business, psychology, and medicine. The formal courses and the tutorial instruction of the Department are planned to prepare students for effective participation in population programs as administrators, research workers, or educators. Programs of study are offered in these areas: population, health, and nutrition; the design, management, and evaluation of population programs; the analysis of complex ecological systems; demographic analyses; and reproductive biomedicine. Although the Department offers a very flexible program, approximately half of the S.M. students are from or are primarily interested in health and population problems of underdeveloped countries. (Please refer to p. 9 for specific degree requirements.)

Admission

Students with bachelor's degrees in biological and/or social sciences, or in other population-related fields, are generally expected to spend two years in residence toward the S.M. degree. Students with prior master's or higher degrees, or extensive work experience, generally complete study toward the S.M. degree in one year. Approximately one-fourth of those who complete the S.M. degree enter the doctoral program.

Career Outlook

Some positions recent graduates have taken: director of a university center for population studies; principal statistician; executive secretary of an international committee on applied research in population; president of a medical services consultants group; medical director of a planned parenthood association; director of a medical clinic; a programme officer for U.N. Fund for Population Activities; a UNFPA coordinator; a population intern for USAID; and an associate programme officer in Health and Nutrition for UNICEF.

Some of the courses that the Department offers are listed below. The corresponding descriptions are on p. 99.

Introduction to Population Sciences; Introductory Seminar on Population Sciences; Departmental Seminar; Basic Demographic Methods; Biological Basis for Fertility Control; Population Analysis in Developing Countries; Population Analysis in the United States; Applied Mathematical Demography; The Spatial Aspects of Societies; Foundations of Agricultural Sciences; Population Biology; An Economic Approach to Population Policy; Comparative Analysis of Public Policies in Developing Countries; Introduction to Community Diagnosis of Birth and Death Rates in Developing Countries; Applied Mathematical Demography Seminar; Formal Models of Movement; The Design and Management of Population Programs; Tutorial Programs; Field Studies; and Research.

In conjunction with other departments:

The American Household in Demographic Perspective and Health Planning in Developing Countries.

Some of the courses offered by the Division of Applied Sciences are listed below. The corresponding descriptions are on p. 102.

Chemistry of the Aqueous Environment; Introduction to Environmental Microbiology; and Concepts and Methods in Microbial Ecology.

Design of Water Resource Systems; Stochastic Processes in Environmental Engineering; Seminar: Models for Environmental Systems Planning; Engineering Systems for Environmental Control; Water Quality and Its Management; Water Pollution Microbiology; Chemical Models of Natural and Polluted Waters; Treatment of Water Supplies and Wastewaters; and Rate Processes.

Department of Sanitary Engineering

Faculty

Harold A. Thomas, Jr., S.B., S.M., S.D., Gordon McKay Professor of Civil and Sanitary Engineering; J. Carrell Morris, S.B., A.M., Ph.D., A.M. (hon.), Gordon McKay Professor of Sanitary Engineering; Joseph J. Harrington, B.C.E., A.M., Ph.D., Professor of Environmental Health Engineering in the Faculty of Public Health and Gordon McKay Professor of Environmental Engineering in the Faculty of Arts and Sciences

Introduction

Members of the Department participate in the School of Public Health through teaching interdepartmental courses such as *Principles of Environmental Health* and *Environmental Health Evaluation and Management*. The courses listed are offered in the Division of Applied Sciences of the Graduate School of Arts and Sciences. Graduates of engineering colleges or scientific schools may be admitted to the Division as candidates for degrees in the Graduate School of Arts and Sciences. They may elect appropriate courses in the School of Public Health as part of the program for these degrees.

Further information can be obtained by writing to the Committee on Admissions, Graduate School of Arts and Sciences, Holyoke Center, 75 Mt. Auburn Street, Cambridge, Massachusetts 02138.

Degrees

Graduate School of Arts and Sciences: Master of Science in a specified field; Master of Engineering; Doctor of Philosophy in a specified field.

Research

Under a contract with the Department of the Interior, Department members and faculty from the Division of Applied Sciences undertook a study of the use of optimization techniques for generating alternatives in water resources planning. Twenty-five river basin models were studied and the analysis is now being extended to the Connecticut River Basin. It includes municipal and industrial water supply, water quality, structural and non-structural flood control, hydropower, pumped storage, and heat dissipation from plants. Other projects involve aquatic chemistry and ecology.

Department of Tropical Public Health

Thomas H. Weller, A.B., S.M., M.D., LL.D., Richard Pearson Strong Professor of Tropical Public Health and Head of the Department

Faculty

Professor Chernin; Associate Professors W. Berggren, Michelson, Pan, and Spielman; Assistant Professors Boyer, Hoff, and Waner; Lecturers Cash, Coolidge, and Daggy

Teaching and Research Staff

Lecturers and Visiting Lecturers Dammin, Fendall, Foege, Hopkins, Kaiser, Mata, Moschella, Most, Mott, Neva, Popenoe, Scrimshaw, Sencer, and von Lichtenberg; Research Associates Cicconi, Maguire, and Sleigh; Assistant Wheeldon

Introduction

The health problems of the tropical regions, as in all poorly sanitated areas, are predominantly of an infectious and nutritional nature. The infectious diseases are the primary concern of the Department of Tropical Public Health, with emphasis given to protozoal, helminthic, and viral entities and to relevant arthropod and molluscan intermediate hosts. Within the framework of the Center for the Prevention of Infectious Diseases, the Department of Tropical Public Health shares with the Department of Microbiology the responsibility for an integrated presentation of information on important infectious agents.

The basic course, Tropical Public Health 201a, is designed to provide students in the Master of Public Health program with knowledge regarding major parasitic diseases, and with factual information concerning the epidemiology and control of selected entities of public health importance.

The resolution of the health problems of tropical areas requires a multidisciplinary approach involving a considered appraisal of human resources as well as of relevant social, economic, and political factors. Thus, the student concentrating in the Department in preparation for a career in the field of international health should, in addition to departmental courses, acquire a broadened experience by elective work in other areas.

Degrees

Master and Doctor of Public Health with concentration in Tropical Public Health; and Master and Doctor of Science in Tropical Public Health.

Research

The investigative program in the Department currently deals with pathogens ranging from viruses to helminths. Studies on the *in vitro* cultivation and the physiology and immunology of a wide variety of agents are in progress. Biological investigations on the molluscan vectors of the schistosomes comprise another area of major interest. Facilities are available for the training of a limited number of students at the Doctor of Public Health or Doctor of Science level. The doctoral degree applicant should, if possible, obtain the necessary medical science background prior to enrollment. Collaborative arrangements established with institutions in the tropics provide diversified opportunities for study and research overseas.

Programs

Tropical Public Health

Goals

The program has the following goals: (1) to provide students who have adequate training in the health sciences with the additional background essential for careers in research or service in developing countries; (2) to introduce students to the significance, recognition, and prevention of the major infectious disease problems of developing countries; and (3) to introduce them to the factors influencing human ecology and social development in such areas.

Curriculum

Students are required to fulfill the distribution requirements for an M.P.H. program (see p. 9) and to take specific specialized courses offered by the Department; the nature of the specialized course work will depend on the interest of the candidate.

Admission

The one-year M.P.H. degree program is designed for persons with prior medical degrees (M.D., D.V.M., D.M.D., D.D.S.) or doctoral degrees in biomedical science who are interested in problems of infectious disease in developing countries.

Career Outlook

Graduates customarily direct programs dealing with the control of tropical diseases or with research on these entities. Posts are in the public or private sector and at the national and international level. A separate career opportunity involves academic work in the area of preventive and social medicine with emphasis on the problems of the developing areas of the world.

Medical and Public Health Parasitology

Goals

The goals of the program are: (1) to acquaint the student with recent advances in the area of parasitic diseases and with the present status of such diseases throughout the world; (2) to develop skills for evaluation of the current literature and of control programs; and (3) to provide adequate background for conducting research on these diseases, including their biochemical and immunological aspects. The master's program is regarded as preparation for doctoral study.

Curriculum

All students must satisfy basic course requirements in biostatistics, epidemiology, and tropical public health. Students usually take advanced coursework in one or more of those disciplines, and also elect courses in health services, environmental health sciences, microbiology, and population sciences, etc., according to their interests. Students commonly cross-register for courses in the Harvard Medical School (e.g., immunology, pathology), the Harvard Graduate School of Arts and Sciences, and at M.I.T. Some of the elective work within the Department of Tropical Public

Health may take the form of tutorials, laboratory research projects, or both. (See p. 13 for specific degree requirements.)

Admission

Students with prior M.D. degrees or doctoral or master's degrees in biological or medical sciences are eligible for admission to this program. The exceptional candidate with a strong biological background but lacking a master's degree will be considered. For the student without prior preparation in pathology, biochemistry, and immunology, two years of course work are customarily required before the S.M. degree is awarded; students with sufficient prior preparation may earn the master's degree in one year. The majority of students go on to earn the S.D. degree and enter careers in research and teaching in the area of medical parasitology.

Career Outlook

Graduates are prepared to pursue academic or administrative careers that deal with the important parasitic diseases of man.

Ecology and Control of Vectors of Disease

Goals

The specific educational goals of the program are: (1) to acquaint the student with the various arthropod and molluscan vectors of disease and to develop an appreciation of the biology of these organisms and the means for their control; (2) to prepare the student to plan and evaluate control programs; and (3) to develop skills with respect to identification, maintenance, and experimental procedures involving these organisms.

Curriculum

In addition to required courses in epidemiology and biostatistics, participants in the program will take courses in vector biology, entomology, malacology, parasitology and microbiology. Depending upon the particular interests of each student, courses in cell biology, invertebrate physiology, pathology, genetics, population ecology and computer sciences may be required. Each participant will conduct a program of original research. (See p. 13 for specific degree requirements.)

Admission

Students admitted to this program normally have prior medical degrees or doctorates or master's degrees in biological or medical sciences. Most students take two years to earn the S.M. degree, although some students with previous education in relevant areas may earn the degree in one year. Almost all recipients of the master's degree continue on for the doctorate, in preparation for careers in teaching and research.

Career Outlook

The primary goal of this program is to train vector biologists for careers in teaching and research in universities and in governmental and international agencies. Graduates are expected to occupy key positions in programs directed toward investigation and controlling vector-borne disease. International health is emphasized. Thus, graduates of the program may engage in basic biological studies and in operational research.

Some of the courses that the Department offers are listed below. The corresponding descriptions are on p. 103.

Ecology, Epidemiology, and Control of Important Parasitic and Viral Diseases of Developing Countries; Perspectives in Tropical Health: The Background for Decision Analysis; Techniques for Investigation of Parasitic Infections; Clinical and Pathologic Features of Tropical Diseases; Principles of Vector Biology; Epidemiology and Control of Schistosomiasis; Current Problems in Malariology; Introduction to the Immunology of Parasitic Diseases; Tutorial Programs; and Research.

In conjunction with Microbiology: Virology.



Centers, Offices, and Nondegree Programs

Center for the Analysis of Health Practices

Efforts to promote equity of access or to improve the quality of health care have often had unexpected, and occasionally adverse, effects on the economy, legal institutions, and even on the efficacy and effectiveness of medical care itself. These complex and poorly understood ramifications of choices in the field of health suggest that decisions ought no longer to be considered the province of any single discipline, and that the study of many problems ought not to be left to the chance association of appropriate experts.

The Center for the Analysis of Health Practices (CAHP) represents one of Harvard University's responses to these needs. Based in the School of Public Health, CAHP provides a focus for the research activities of members drawn from the Faculties of Medicine, Government, Law, and Arts and Sciences, and the Departments of Health Services and Biostatistics of the School of Public Health. Members of the Center include some 25 physicians, economists, policy analysts, statisticians, sociologists, engineers, and systems analysts who are engaged in collaborative research dealing with the application of a new technology to health care, medical economics, and the evaluation of medical interventions and primary care. In each of these subject areas, the investigative approach is directed at issues of efficacy, cost-effectiveness and public policy. In order to carry out its research agenda, CAHP has established collaborative relationships with most of the major teaching hospitals affiliated with Harvard Medical School, other providers of health care, insurance companies, and agencies of local, state and federal governments.

The research output of the Center appears in books, monographs, serial publications, discussion papers and, for a more general audience, in a quarterly *Newsletter* distributed to more than 5,000 individuals in government, business, insurance companies, state medical and hospital associations, medical schools and universities, and provider institutions.

The Center offers a variety of means for students to participate in the conduct of its research. One such opportunity is provided by the *Seminar Program in Health and Medicine*, jointly sponsored by the Department of Biostatistics and CAHP. The Seminar consists of small working groups, each made up of interested individuals from within as well as outside the University, which spend one or more years working on particular problems in the health sector. The entire membership of the Seminar meets biweekly for dinner at the School of Public Health, following which the component working groups spend the evening addressing their areas of research interest.

In addition, students whose dissertations concern issues in the health sector may wish to use the Center as a resource during the development of their theses. Alternatively, a limited number of students may find opportunities to participate in Center-sponsored research projects during the period of their enrollment in the University.

Students and faculty members who do not have a formal relationship to the Center may remain aware of the research activities of its members by attending the weekly "brown bag" workshops which serve as the major vehicle for communication among the members of the Center and their collaborators. These working seminars provide an opportunity for the discussion of potential projects, methodologic problems, or projects in progress. The Center also sponsors during each academic year a series of Public Health Rounds. These Rounds offer a forum for visiting scholars, scientists and physicians to explore significant policy aspects of problems affecting health, and to consider the effectiveness of alternative strategies for dealing with these problems. All members of the academic community are welcome to attend.

Inquiries about programs or activities of the Center should be directed to its staff. The Director is Howard S. Frazier, M.D.; Associate Directors are Peter Braun, M.D., Herbert Sherman, D.E.E., and Eleanor Druckman, M.S.

Center for Population Studies

The Center for Population Studies was established in 1964 under the leadership of the School of Public Health, as a university-wide Center to join scholars and scientists in different fields in a common approach to human population problems. The members and research associates of the Center are drawn from the Departments of Biology, Economics, Government, and Sociology; the Division of Applied Sciences; and the Schools of Public Health, Design, Education, Medicine, and Divinity. The Center is located at 9 Bow Street, Cambridge.

In the School of Public Health, the Department of Population Sciences welcomes qualified candidates for the various degrees offered by the School. Courses open to all qualified students are also given by members of the Center in the Department of General Education and in the other parts of the University listed above.

The present research programs of the Center and the Department focus on several themes: laboratory and clinical research programs in human reproductive biology; economic, social, and environmental determinants and consequences of population change in America and other developed and developing countries, including public health aspects of fertility and the balance between populations and their resources; problems of urbanization and internal migration in both developed and developing countries; theories of population kinematics and dynamics and their implications for public policy; political and ethical aspects of population policy; historical population studies; population education; and adolescent growth and menarche.

The Acting Director of the Center is Nathan Keyfitz, Ph.D.

Center for the Prevention of Infectious Diseases

The Center for the Prevention of Infectious Diseases comprises the Departments of Microbiology and Tropical Public Health. Working in close collaboration, the staffs of the two Departments are concerned with the broad spectrum of agents that parasitize man and with their relevant arthropod and molluscan vectors.

On a global basis the infectious diseases remain a primary cause of mortality. In the developed areas of the world, morbidity attributable to infectious diseases persists as a major impediment to the enjoyment of health. An increasing number of chronic degenerative diseases are recognized as stemming from the insults of prior infectious processes. In many societies, acceptance of the concept of population control awaits containment of undue mortality induced by the infectious diseases and the consequent assurance that children who are born will have a reasonable prospect of achieving maturity. Considerations such as the foregoing emphasize the continuing need for the public health expert to possess knowledge of the rapidly changing technology of the control of infectious diseases, as well as basic knowledge concerning the attributes and epidemiologic characteristics of the responsible agents.

The faculty of the Center for the Prevention of Infectious Diseases work together to discharge a common responsibility for multidisciplinary instruction in the various facets of diseases of infectious etiology. The formal course offerings of the two Departments are designed and scheduled to permit the acquisition of a broad basic knowledge of infectious diseases as well as an introduction to specialized subject areas. For qualified advanced students, concentration in specific areas with participation in collaborative or individual research is encouraged at both predoctoral and postdoctoral levels. The wide variety of current research projects in the Center permits acquisition of experience both at home and abroad, in the laboratory or in the field.

The Director of the Center is Thomas H. Weller, M.D.; the Associate Director is Roger L. Nichols, M.D.

The Kresge Center for Environmental Health

This Center includes the Departments of Physiology, Sanitary Engineering, and Environmental Health Sciences. The Center serves as a focus for environmental health and occupational health activities within the School of Public Health. Full-time faculty within the Center include physicians, engineers, physiologists, mathematicians, toxicologists, chemists, physicists, and other professionals. This diversity enables the staff to deal effectively with environmental and occupational health problems which require a multidisciplinary approach.

Specific categories in which the Center conducts research and training include:

1. Air pollution effects and control
2. Environmental toxicology
3. Radiation biology
4. Medical radiological physics
5. Radiological health (radiation protection)
6. Respiratory physiology
7. Sanitary engineering
8. Environmental health management

Degree programs include the Master of Public Health, Master of Science, Master of Industrial Health, Doctor of Science, and Doctor of Public Health. Formal requirements for each of these degrees are outlined in other sections of the catalog. Students interested in any of the above areas ordinarily enroll in the School of Public Health. Students whose primary interest is in problems of water quality and water resources generally enroll in the Division of Applied Sciences of the Graduate School of Arts and Sciences.

Educational Resource Center for Occupational Safety and Health

The overall objective of the Educational Resource Center is to train professionals who will be involved in preventing occupational disease and injury. Employment opportunities exist in universities, governmental agencies, industry, and labor. The educational programs mentioned here are currently supported by a grant from the National Institute of Occupational Safety and Health. This grant provides tuition and stipend support for qualified individuals. For further information about any aspects of the four educational programs listed below, contact John M. Peters, M.D., Director of the Occupational Health Program. Formal requirements for the degrees are on pp. 9-17.

Occupational Medicine

Training in occupational medicine at the Harvard School of Public Health consists of two years of training in the public health disciplines relevant to the prevention and control of occupational disease and injury. The first year is primarily didactic and can lead to the Master of Public Health, Master of Science or Master of Industrial Health degrees. The basic course requirements are listed under the Master of Industrial Health degree. The second residency year consists of applying the skills learned during the first year to problem solving and research. Health hazard evaluations are conducted with faculty supervision, residents are encouraged to become involved in research projects, and other training activities relevant to the resident's interest can be arranged in industry, government or labor unions. Upon completion of this two-year program, physicians are eligible for certification by the American Board of Preventive Medicine (Occupational Medicine).

Industrial Hygiene and Safety

The two-year master's program in industrial hygiene and safety is designed to help meet the demand for professional personnel with the skills and scientific knowledge needed to identify and control health problems that exist in the workplace. The curriculum generally includes recommended and required courses dealing with basic problems in occupational health and industrial environments, environmental control, identification and measurement of air contaminants, air and gas cleaning, principles of toxicology, and aerosol technology.

Candidates for the program normally have a baccalaureate degree in engineering, chemistry, physics, or biology. Those with master's degrees in the above disciplines or prior training or experience in related areas may be able to earn the S.M. degree in one year.

Occupational Safety and Health

A small number of individuals with a baccalaureate degree and with advanced training in social or natural sciences may gain admission to a S.M. or M.P.H. degree program in occupational safety and health. The program can emphasize either the epidemiologic or policy aspects of occupational safety and health. An individual with a Ph.D. or J.D. degree may complete the program in one year.

Occupational Health Nursing

The Occupational Health Program is involved with Boston University in providing a two-year master's degree program for nurses with previous baccalaureate degrees. One year consists of didactic training in occupational safety and health at Harvard; the second year consists of graduate training in nursing aspects of occupational safety and health at Boston University.

The Director of the Kresge Center is James L. Whittenberger, M.D. The Associate Director is Dade W. Moeller, Ph.D.

Office of Extramural Health Programs

The Office of Extramural Health Programs has established and is strengthening working relationships with components of the health system, including governmental agencies, providers of health services, and organizations of consumers. A principal objective is to provide training positions for students and research opportunities for faculty in operating health agencies and organizations outside the academic setting.

Working relationships with a wide spectrum of providers, payors, and regulators have developed into a unique blend of technical assistance, education, and research. The Office is currently involved in a major joint effort with the Peter Bent Brigham Hospital and the Affiliated Hospitals Center to develop an innovative service and training program in primary medical care and health services administration.

The Director of the Office is H. Richard Nesson, M.D.

Office of International Health

The School provides opportunities for preparation for careers in teaching, research, and service in international health. Various programs available within the School, together with related course offerings in other divisions of Harvard University and the Massachusetts Institute of Technology, offer students a broad background for future careers with international agencies, mission groups, philanthropic foundations, and foreign governmental and academic institutions. Cross-registration opportunities are available for students interested in medicine, economics, public administration, education, anthropology, government, social relations, and related subjects appropriate to particular regions of the world. (Students may also cross-register for courses in foreign languages, but may not receive credit for such courses toward degrees being earned at the School.)

The Office of International Health exists to advise students from overseas and U.S. students with interests in international health in the selection of appropriate programs and courses. The Director of the Office is Joe D. Wray, M.D., M.P.H., assisted by Gretchen M. Berggren, M.D., S.M. in Hyg., and Richard A. Cash, M.D., M.P.H.

The Cooperative Health Improvement Program

The primary goal of the Cooperative Health Improvement Program (CHIP) has been to establish three off-campus programs of service, education, and research to augment established activities at the Harvard School of Public Health. Beyond this the ultimate objective is to effect improvement in health services and health nationally by developing, implementing, and evaluating new public health policies and strategies that may be adapted elsewhere.

CHIP is based in three geographic areas: 1) the city of Cambridge, 2) Bos-line, which includes four Boston neighborhoods and the town of Brookline, and 3) Eastern Middlesex, which includes five suburban towns. The basic education goal of CHIP is to establish an externship program in each area with supervised practical experience in a variety of professional settings. An externship ordinarily consists of one summer of paid work and/or one day per week during the academic year. Supervision of externs is shared among field preceptors, CHIP staff members, and School faculty.

The service goals of CHIP are fulfilled by externs and by CHIP staff who may directly assist field personnel in problem solving efforts aimed at improving the equity, efficiency and effectiveness of health service delivery systems, and improving the utility of policy relevant information and evaluation techniques.

Finally, CHIP demonstration and research activities are guided by more general needs for new public health knowledge, understanding and management technology. These projects are developed by CHIP staff, faculty

members who become associated with CHIP, and by doctoral students.

CHIP is currently operating in the third year of a four-year grant from the W. K. Kellogg Foundation. The Principal Investigator is H. Richard Nesson, M.D. The Director is J. Larry Brown, Ph.D.

Executive Programs in Health Policy and Management

Executive Programs in Health Policy and Management was established in 1974 to develop and conduct educational programs for executives engaged in management and regulation in the health and environmental fields. The programs are residential and range in length from three days to six weeks. The short programs focus on specific topics or roles, such as finance or trusteeship; the longer programs focus on management skills and policy analysis.

The programs are structured to bring together: an intensive, focused curriculum designed to develop managerial and analytical expertise; a multidisciplinary faculty experienced in executive education drawn from several professional schools at Harvard; participants with a wide range of personal and professional experience; an interactive learning climate requiring serious individual study and active contribution; and a full-time, residential experience promoting extensive exchange of insights among faculty and participants.

Participants in the programs are sponsored by their employer organizations: health care providers; federal, state and local government agencies in health and the environment; national, regional, and local planning and regulatory agencies; corporations; professional, trade, and public interest organizations; legislative committees; and fiscal intermediaries.

A core faculty is drawn from the Harvard School of Public Health; representatives from the Faculties of Business, Government, Law, and Arts and Sciences also teach in the programs. The programs are taught primarily by the case method, which requires the active involvement of the participants in the analysis of problem situations and the development of solutions to them.

The Programs offered in the last year have included: Health Systems Management; Health Policy, Planning and Regulation; Environmental Policy and Management; Chiefs of Clinical Services; Financial Management and Strategy in Health; Managing Multi-Institutional Collaboration; and Hospital Trustees.

Participation in Executive Programs is applicable to the A.M.A.'s Physician Recognition Award Category I Credit.

The Director of Executive Programs is Alan Sheldon, D.P.M., S.M. in Hyg.

Interdisciplinary Programs in Health

The primary objectives of Interdisciplinary Programs in Health (IPH) are to enlist scholars from the natural and social sciences in finding new ways to deal with the critical health problems of today's society and to attract and train for health fields young and midcareer people with strong backgrounds in a natural or social science.

IPH is designed to bring to health problems the knowledge, skills, insights and analytic techniques of a variety of disciplines. It is a university-wide program, based at the School of Public Health. Members of the Faculties of Arts and Sciences, the John F. Kennedy School of Government, Law, Medicine and Business participate in IPH.

IPH presently focuses on environmental health with particular emphasis on issues of both science and public policy related to chemicals in the environment.

Over 40,000 chemicals are currently in production and more than 500 additional ones are introduced each year, many of them biologically active. The problems raised by these chemicals provide the initial emphasis of IPH. The studies will range from the assessment of biochemical effects at the cellular level to risk assessment methodology and the regulatory process. Individual programs will reflect the interests and wishes of participants.

It is not a degree granting program.

The Participants

IPH provides opportunities for:

1. Promising graduates of advanced degree programs in the natural or social sciences seeking preparation for careers in which their talents can be applied to health-related problems, either through fundamental or applied research or through service.
2. Senior scientists and scholars who have made significant contributions in a discipline and now wish to apply their discipline to health-related problems.
3. Individuals from government or industry who have been involved in problems of environmental health and regulation and wish to broaden their background and perspective.

In addition, IPH seeks to create new cooperative links among scholars within Harvard University as they work on problems relating their fields to applied health research.

The program has several components. First, research may be done individually, in collaboration with existing research groups, or with new interdisciplinary teams. Second, seminars and working groups will explore particular problems and develop papers and monographs. Third, Fellows, and Visitors meet together regularly, joined by members of the Harvard faculty and distinguished guests, to exchange experiences and to discuss important issues related to health.

IPH Fellows

Postdoctoral fellowships will be awarded for terms of one or two years, as appropriate, and may be renewable for a third year.

Fellows will be chosen from the natural sciences (chemistry, biology, biochemistry, physics and mathematics), the quantitative analytic areas (statistics, operations research, engineering, computer science, etc.) and the social sciences (economics, sociology, public policy, law, management, etc.).

Those selected will devote their initial period to orientation, exploration of opportunities and selection of projects and advisors. Experimental facilities will be made available in the laboratories of existing research groups.

For further information on admissions requirements, contact: Dr. Donald F. Hornig, Director.

Visiting Scientists and Scholars

A number of midcareer appointments will be made in 1980 for terms of up to one year. Visitors may be on leave from universities, industry, or public interest organizations. Stipends will be adjusted to individual circumstances and the availability of other support to the applicant. Applicants should submit a curriculum vitae, a list of publications, a proposal for research or study to be undertaken in IPH and a statement of the relation of IPH to their career objectives.

It is expected that participants will leave IPH prepared to work on health problems in federal, state and local governments, in industry and in research and, in some instances, to launch related programs at other universities.

General Information

History of The Harvard School of Public Health

Professional education in public health had been steadily increasing in Harvard University for more than two decades before the actual founding of the School in 1922. Its gradual development was characterized by certain important steps, the first of which was the establishment, in 1909, of the Department of Preventive Medicine and Hygiene in the Medical School — the first such department in the United States. The degree of Doctor of Public Health was first conferred in 1911. In that year a Department of Sanitary Engineering was established in the Graduate School of Engineering. In 1913, the Department of Tropical Medicine and, in 1918, the Division of Industrial Hygiene, with clinical and laboratory facilities, were organized in the Harvard Medical School.

Also in 1913, the Harvard–Massachusetts Institute of Technology School for Health Officers was formed under the joint management of Harvard University and the Massachusetts Institute of Technology. This School operated until the fall of 1922, when it was superseded by the Harvard School of Public Health, made possible by an endowment for this purpose from the Rockefeller Foundation.

In the early years of the School's operation, several of its departments functioned as joint departments with counterparts in the Medical School, sharing facilities, faculty, and budgets. In 1946, the School was separated administratively and financially from the Medical School and became an autonomous unit of Harvard University. It continues to cooperate with the Medical School in teaching and research, and has also developed close associations with other divisions of the University, particularly the Graduate School of Arts and Sciences, the John F. Kennedy School of Government, and the Graduate School of Business Administration.

The School participates in both professional and graduate education and offers the degrees of Master and Doctor of Public Health, Master and Doctor of Science, and Master of Industrial Health.

Location and Resources

The main buildings of the School are the Health Sciences Laboratories at 665 Huntington Avenue, and the Sebastian S. Kresge Educational Facilities Building at 677 Huntington Avenue, Boston. These buildings are near the Harvard Medical and Dental Schools; the Countway Library of Medicine; the Children's Hospital Medical Center; the Beth Israel, Peter Bent Brigham, and Boston Women's Hospitals; and other Harvard-affiliated hospitals. The School, including its Center for Population Studies, also has offices in Cambridge.

Health Sciences Computing Facility

Computing and data processing resources are available to students through the Health Sciences Computing Facility (HSCF), which is operated by the School of Public Health. A staff of computer programmers and analysts assists researchers and students from all of the Harvard Medical Area

institutions in using the computer as a tool for analyzing data, for doing extensive numerical calculations, and for acquiring, maintaining, and processing large data bases.

HSCF is equipped with unit record machines, including a variety of card punching machines. Remote batch processing computing is accomplished by a high-speed telephone link to the ITTEL AS/5 computer at the Harvard Computing Center on the Cambridge campus. Interactive computing (time-sharing) capability is provided by a variety of terminals which are connected to three HSCF computers, as well as computers at the Harvard Computing Center, the Massachusetts Institute of Technology, and Dartmouth College.

HSCF is equipped with three time-sharing computers, two PDP 11/70s and a PDP 11/34. The PDP 11/70s can accommodate up to sixty-four simultaneous users, have an industry-compatible magnetic tape unit, and use the UNIX operating system. The PDP 11/34 uses the MUIS operating system, which is a commercially available version of the widely used MUMPS system. It can accommodate up to thirty-two simultaneous users and features a number of medical information programs, a teaching program, and specialized medical and health data bases. Low-speed teleprinter and video terminals are available in the School to allow students, faculty, and staff to have access to these computers.

HSCF staff members participate in several computing courses given by the Department of Biostatistics. There are also special tutorials (Biostatistics 313a,b,c,d) for interested students who have had prior computing experience. The Director of the HSCF is Dr. Raymond K. Neff.

Libraries

The library needs of the School are served principally by the Francis A. Countway Library of Medicine, located at 10 Shattuck Street. The Countway Library combines the resources and services of the Harvard Medical Library and the Boston Medical Library. Among libraries serving medical and health-related schools, it is the largest in the country, with recorded holdings of more than 460,000 volumes and 4,800 periodicals. The Countway Library also has extensive collections of historical materials, dating from the fifteenth century. Its history of medicine department provides modern facilities for the use of these books and other rarities.

All members of the University may borrow from the Harvard College library at Cambridge. Messenger service is provided daily between the college library, various other Harvard University libraries, and the Countway Library. The Boston Public Library, libraries of the Massachusetts Institute of Technology, and other libraries of the Boston area add to the total book and periodical resources available to students.

Other Resources

Students at the School may enroll in courses in other divisions of Harvard University, e.g., in the natural sciences, public administration, economics and other social sciences, statistics, and medical sciences. Many graduate

courses at the Massachusetts Institute of Technology are also open to students at the School. Students will generally be granted credit for such courses toward degrees being earned at the School of Public Health, with the exception of courses in foreign languages. Credit granted for cross-registered courses may not exceed one-half of the credit units required for the degree in question.

The School maintains a close association with a wide variety of health, medical care, and welfare organizations in Massachusetts and elsewhere. The facilities of hospitals and certain other institutions adjacent to the School are available to qualified students. Other local, national, and international health facilities provide opportunities for observation and special studies, and members of their staffs are available to assist in the School's educational program. The State Laboratory Institute of the Massachusetts Department of Public Health offers opportunities for qualified students to obtain experience in laboratory methods pertinent to public health.

Admission

Application for Admission

Application forms for admission to all degree programs and for special student status can be obtained from the Admissions Office, Harvard School of Public Health, Room G-4, 677 Huntington Avenue, Boston, MA 02115.

Applicants must submit the following for consideration by the Committee on Admissions and Degrees: (1) completed application form; (2) transcripts of academic record at college, graduate school, and/or professional school; (3) names of at least three people, well acquainted with the applicant's previous work, from whom letters of recommendation have been requested. In addition, the Graduate Record Examination is required of certain applicants, as noted elsewhere in this catalog.

An application fee of \$25, which is not refundable, is required for each formal application. A check drawn on a bank in the United States, a postal money order, or an international money order, payable to the Harvard School of Public Health, must accompany the application.

In addition to fulfilling the specific requirements for admission to a degree program, applicants must satisfy the Committee on Admissions and Degrees as to their ability to undertake advanced study at a graduate level. The final decision as to the admissibility of an applicant rests with the Committee.

The School is unable to accept all who are eligible for admission. Therefore, persons who wish to be considered for admission must submit their applications by *February first* prior to the academic year in which they wish to enroll.

Admission of a candidate is for a particular year; if enrollment at that time is not possible, reapplication is necessary and will be considered on the same competitive basis as a new application. Exceptions to this must be approved by the Committee on Admissions and Degrees.

As a matter of policy, Harvard University does not discriminate among applicants and students in admissions, educational policies, scholarship and loan programs, and athletic and other programs on the basis of race, religion, sex, national origin, color, creed, handicap, or age. The School encourages women and members of minority groups to apply for admission. Increasing numbers of students with disabilities are enrolling at Harvard and are participating in a wide range of programs and activities. Everything possible will be done to meet special needs. There are, however, no separate academic programs for either the physically handicapped or for students with learning disabilities; all enrolled students undertake the same program. The Associate Dean for Student Affairs has been designated to assist handicapped students and employees in adapting to life at the School.

International Students

Language Proficiency

Applicants from countries in which the language of instruction is not

English must satisfy the Committee on Admissions and Degrees as to their ability to speak, read, write, and understand the English language competently. Only students who have shown evidence of academic excellence and who can understand rapid, idiomatic English and can speak, write and read English with a high degree of facility should apply for admission. Students should be advised that they may be required to attend ten or more classes each week and to write frequent short examinations. No allowance is made for students whose English is not sufficient for these demands; therefore, any deficiency must be made up before applying for admission. The School requests that foreign applicants take and pass satisfactorily the Test of English as a Foreign Language. The test is administered four times a year at centers throughout the world. Applicants are advised to take this test as early as possible in the admissions process. Information concerning the test may be obtained by writing to the Test of English as a Foreign Language, Box 899, Princeton, New Jersey 08540. Certification of English proficiency must be received by the School before the immigration form needed to obtain a visa to enter the United States can be issued to the student.

Financial Certification

The School has adopted the following policy regarding foreign nationals who are applying for admission from outside the United States. An applicant whose financial support is not guaranteed by an official U.S. agency or foundation must submit evidence satisfactory to the School that he or she will have sufficient funds available in U.S. currency to pay the expenses for the full period of his or her academic program, and that he or she is permitted to exchange or export these funds. Certification of adequate financial resources must be received by the School before the immigration form needed to obtain a visa to enter the United States can be issued. Foreign students who are wholly supported by personal funds will be required to have adequate funds on deposit in a U.S. bank before the immigration form will be issued.

Foreign nationals admitted to the School and already residing within the United States will also be required to submit satisfactory evidence of sufficient funds to cover their expenses for the full period of their academic program. Such students will not be permitted to register at the School unless certification of adequate financial resources has been received.

An estimate of living expenses in the Boston area may be found in the section entitled "Living Expenses" on p. 74.

Hospital Insurance

All nonimmigrant foreign students are required to enroll in the Harvard Blue Cross/Blue Shield student insurance plan. More information about the plan is included in the section entitled "Registration and Tuition".

All inquiries and communications regarding admission should be addressed to the Director of Admissions at the address given above.

Degree Candidates

Full-Time

Credit units are assigned on the basis of the total amount of time required by a course, both in class and outside of class. Twenty credit units constitute a full program for one term. A full-time student may register for no more than 25 credit units per semester unless permission is obtained from the Committee on Admissions and Degrees.

Part-Time

Students may register as part-time degree candidates with the approval of the Committee on Admissions and Degrees. Ordinarily this requires half-time attendance; however, full-time full tuition requirements for the degree must be met (see tuition and registration guidelines, p. 72). A one-year program may be completed in two academic years, a two-year program in three academic years. Ten credit units per term constitute a regular program for half-time students. Half-time students may register for no more than 12.5 credit units per term.

The Grading System

Beginning in the Fall of 1979, the grading system will be as follows: Courses on the 100 and 200 level may be taken with ordinal or pass/fail grades. The ordinal system used for 100 and 200 level courses will be A,B,C, and F. The grades will have the following numerical values: A=4.0, A-=3.7, B+=3.3, B=3.0, B-=2.7, C+=2.3, C=2.0, C-=1.7, F=0. Courses at the 300 level may only be taken pass/fail.

Minimal grade point average requirements and distributional requirements will be instituted for all students entering degree programs in the fall semester of 1979 and thereafter. Semester and cumulative grade point averages will be computed on courses taken on an A,B,C,F basis anywhere at Harvard and M.I.T. Courses taken pass/fail or on grading systems other than A,B,C,F will not be calculated in the grade point average. The minimal standard per semester for satisfactory work will be 2.7; students must have that average or above to qualify for a degree. Individual departments and programs may set more restrictive standards.

Students taking a one-year degree program are required to take a minimum of 30 credits on the A,B,C,F basis and the remainder as the student elects. Students taking degree programs lasting two or more years are required to take a minimum of 60 credits on the A,B,C,F basis and the remainder as the student elects. Doctoral students must receive grades of either A or B in courses counted for their major or minor fields.

A detailed description of the grading system appears in the *Student Handbook*.

Requirements for Nondegree Status

Courtesy Students

Persons holding Harvard Corporation appointments are permitted to enroll in courses at the School with the permission of the instructor and the Registrar. Harvard employees should consult the Personnel Office about the provisions of the Harvard Tuition Assistance Plan. Employees from other hospitals and universities participating in tuition plans should consult the Registrar about the availability of space in courses of interest to them. Courtesy students may take a maximum of five credits per semester. In courses with restricted enrollment, preference is given to degree candidates.

Special Students

The School may accept a few students who are not degree candidates. Procedures and requirements for the admission of such students are the same as for degree candidates. Admission of these special students to courses is subject to availability of space and the permission of the instructor. Candidates should specify on the application form the courses they plan to take. Admission as a special student carries with it no commitment to accept the applicant as a degree candidate and is limited to one academic year. Special students who wish to be admitted to degree candidacy must reapply and will be considered on the same basis as other applicants for admission.

After admission to degree candidacy, students may petition the Committee on Admissions and Degrees to count toward academic requirements courses taken as a special student or courtesy student (i.e., while in non-degree status). Permission may be granted if the courses fit into the student's academic program. Tuition credit is not given for these courses, and students who are granted such permission must still meet the tuition requirements for the degree. (See p. 72 for tuition guidelines.)

Registration and Tuition

Tuition and Fee Schedule

The tuition fees for the academic year 1979-80 are listed below:

\$5,000*	Full-time resident tuition
2,600*	Half-time resident tuition
2,650*	Doctoral reduced tuition
1,400*	Doctoral half-time reduced tuition
600*	Doctoral facilities fee (resident)
225	Nonresident doctoral guidance fee
25	Active file fee for degree candidates on leave of absence
	Part-time special students enrolled for 6 to 9 credit units per term:
220*	First credit unit of work per term
120	Each additional credit unit
	Part-time special students enrolled for 5 or fewer credit units per term:
120	Charge per credit unit per term
	Degree candidates who register and receive credit for research or supervised study during the 1980 summer session:
600	Five-credit program
10	Late Registration Fee
10	Late Study Card Fee
10	Drop-Add Petition Fee (for each petition filed)

The starred amounts include the University Health Service fee for medical care for all resident students enrolled for 6 or more credit units. This fee may not be waived. University Health Service coverage extends from September 1 through August 31.

Hospital insurance is billed separately. A Blue Cross/Blue Shield student insurance plan provides coverage for many costs of medical care not offered at the University Health Services. Coverage under this plan extends from September 1 through August 31. The tentative premium for 1979-80 is \$200. The Blue Cross/Blue Shield student insurance plan is compulsory for all nonimmigrant foreign students; all other students are also enrolled in the plan unless they have other adequate medical insurance and submit a waiver within two weeks following registration. Waivers are approved by the Director of the University Health Services.

For the registration period in which a dissertation is formally approved and accepted by the Department and the Committee on Admissions and Degrees, a Doctor of Science or Doctor of Public Health candidate must have paid at least half of the then current facilities fee.

It should be noted that nonresident doctoral students are not eligible to participate in any Harvard health plan. For continued Blue Cross/Blue Shield coverage, non resident doctoral students must file special forms with the student insurance office in Holyoke Center by the deadlines published for each semester.

Payment of Fees

Bills for tuition and fees will be issued and payable as follows:

Student term bill worksheets for the fall term will be issued on August 1, and will be payable in full by August 20.

Bills for the spring term will be issued in early January, and will be payable in full by January 25.

Payments may be scheduled over monthly installments (four each term) through an optional payment plan that is available at a service charge of \$15 per term.

A student who leaves the School during the academic year is responsible for tuition charges in accordance with the following:

Leaves by		Percent of Total
First Term	Second Term	Semester Charges
October 25	February 25	25%
November 25	March 25	50%
December 24	April 25	75%

Students leaving after December 24 and April 25 of the first and second terms, respectively, are responsible for full tuition charges.

Students who are candidates for degrees must have paid all bills to the University at least one day before the day upon which the degrees are to be voted.

A student who leaves the University for any reason whatever must pay all charges against him or her immediately upon receipt of a bill from the Office of Fiscal Services. Every student is held responsible for the payment of fees until he or she has notified the Dean of his or her intention to withdraw from the School.

All term bills are sent to the student at his or her local address unless the Office of Fiscal Services is requested in writing to send them elsewhere.

Any student whose indebtedness to the University remains unpaid on the date fixed for payment is deprived of the privileges of the University. Reinstatement is obtained only by consent of the Dean of the School in which the student is enrolled after payment of all indebtedness and a reinstatement fee of \$10. As a further condition of reinstatement, the student is required to file with the Office of Fiscal Services a bond in the amount of \$1,000 as security for the payment of future term bills.

Registration and Tuition Guidelines

The following guidelines for payment of tuition apply as stated to all students who enroll at the School of Public Health for the first time on or after September 1, 1979. The guidelines also apply to students enrolled at the School before that date, with the exception of certain aspects of the policy concerning payment of tuition by doctoral candidates. Information concerning the applicability of the guidelines to doctoral students enrolled in a degree program at the School during the academic year 1977-78 can be obtained from the Registrar's Office.

Degree Candidates

After admission to the School of Public Health and until fulfillment of requirements for the degree, all degree candidates must be registered continuously in one of the following registration categories:

1. Resident students
2. Nonresident doctoral students
3. Students on leave of absence

All degree candidates must pay the appropriate tuition rate for each registration period as described below; they may not pay tuition on a "per credit" basis. It should be noted that, in order to qualify for deferment of an educational loan, a student must be registered for no less than a half-time study program.

Tuition for summer school courses may not be credited toward any tuition requirements for the degree.

1. *Resident Students*

All degree candidates who are enrolled in courses or who intend to use any Harvard academic facilities for an extended period of time must register as resident students.

Students who are registered in a master's degree program in the School will be charged full tuition.

Students who are registered in a doctoral degree program in the School will be charged full tuition for two years (with up to one year of credit for full tuition paid as a currently enrolled master's degree candidate at the School), followed by one year of reduced tuition. For subsequent terms of enrollment the facilities fee will be charged, which provides for full access to Harvard academic facilities and the University Health Services, and for the issuance of a Harvard resident identification card.

Part-Time Resident Students

Any degree candidate who registers for less than full-time must in any event fulfill the full-time full tuition requirements for the degree. A master's degree student completing a two-year program in three years must plan to pay at the full-time full tuition rate during the first year and half-time tuition each subsequent year at the rate for that year.

2. *Nonresident Doctoral Students*

Doctoral students who no longer reside in the Greater Boston area* and who are engaged in less than half-time work on the degree and who have received permission from their department and the Committee on Admissions and Degrees to pursue a portion of their programs *in absentia* will be charged the nonresidential doctoral fee. Students in this category normally will have completed payment of at least the required two years of doctoral full tuition and one year of reduced tuition before applying for *in absentia* status; they must in any case complete this payment prior to their graduation and will be billed accordingly while in non-resident status.

Doctoral students *in absentia* are charged the nonresident doctoral guidance fee, which covers periodic consultation with the student's doctoral adviser but does not provide for the use of Harvard facilities or for the issuance of a Harvard identification card. Also, as noted above, a student registered for less than a half-time study program may not qualify for deferment of an educational loan. Upon expiration (or earlier termination) of CAD permission for *in absentia* status, or for a term in which use of Harvard facilities is required, the appropriate resident rate will be charged.

3. *Students on Leave of Absence*

Degree candidates who will not, during a given registration period, be engaged in study or research for a degree from the School, and who will be making no use of Harvard facilities, must apply to the Registrar for a leave of absence. Leaves of absence are ordinarily granted for a maximum of two registration periods and require approval of the student's department and of the CAD.

Students on leave of absence are required to pay the active file fee to maintain their degree candidacy. Upon expiration (or earlier termination) of CAD permission for leave of absence, students will be charged the appropriate tuition rate.

Termination of Degree Candidacy

Students who do not intend to register in any one of the categories noted above must terminate their candidacy for the degree. Such students are required: (1) to file in the Registrar's Office a written notice of intent to withdraw; (2) to inform their department; and (3) to arrange an exit interview with the Financial Aid Office, when appropriate. If students do not terminate their degree candidacy formally but fail to register for a full term or longer, degree candidacy will be terminated automatically.

The CAD, with departmental recommendation, may terminate a student's degree candidacy on the basis of unsatisfactory performance in coursework. Candidacy also will ordinarily be terminated in the case of a student who has exceeded the five-year limit for completion of degree requirements following registration as a doctoral candidate. Doctoral can-

*Students residing within a 50-mile radius of downtown Boston will normally be considered resident for tuition purposes.

didacy may be terminated as a result of failure to submit an acceptable proposal for the thesis. Also, the Faculty Council may recommend termination of candidacy in matters involving academic discipline.

A student who wishes to reactivate degree candidacy should file an application for readmission, which must be approved by the department and by the CAD. Prior to readmission, the student must pay any outstanding bills to the University, as well as the then-current active file fee for each registration period that has elapsed since the termination of candidacy.

Nondegree Candidates

Requirements for admission to nondegree programs are described on p. 69.

Special students registered for full-time or for half-time study programs will pay the corresponding full tuition rate; those registered for less than half time will pay tuition on a "per credit" basis as outlined in the tuition and fee schedule.

Field Studies

Field opportunities, listed under each department's course offerings and bearing the course number 330, often entail travel expenses that must be met by the student. Information about estimated expenses should be obtained from the appropriate department.

Financial Information

Living Expenses

Living costs in the Boston area are higher than in most areas from which students come. The following are *minimum* amounts estimated that students will need in the academic year 1979-80 in order to cover expenses for approximately nine months. A single person will need at least \$10,300, in addition to travel expenses, to cover the cost of tuition and health insurance (\$5,200), rent (\$2,700), and other living expenses (\$2,400). A family of four will need at least \$16,500, in addition to travel expenses, to cover the cost of tuition and health insurance (\$5,200), rent (\$3,500), and other living expenses (\$7,800), including medical care.

Housing

The Henry Lee Shattuck International House is an apartment residence operated on a nonprofit basis by the School for its full-time students and their families from the United States and abroad. Located at 199, 203, and 207 Park Drive, within walking distance of the School, the House consists of sixty-five individual apartments, each with its own kitchenette and bath.

All apartments are rented furnished with basic items except for linens, blankets, and kitchen utensils. No unfurnished units are provided. The monthly rent charge includes all utilities — hot water, heat, gas, and electricity — but not telephone service.

Applications should be submitted by May 15, although late applications will be considered as long as space is available. For application forms and more detailed information, write to Carol O'Connell, Office of Student Affairs, Room G-4, Harvard School of Public Health, 677 Huntington Avenue, Boston, Massachusetts 02115.

The Office of Student Affairs maintains an up-to-date list of private housing and local real estate agencies.

The Harvard University Housing Office in Cambridge arranges for housing in University-owned complexes. Information and application forms may be obtained by writing to the Harvard University Housing Office, 7 Holyoke Street, Cambridge, Massachusetts 02138. A copy of the student's letter of acceptance from the School must be enclosed to prove affiliation. This Office also maintains listings of apartments and houses not owned by the University. These listings must be viewed in person; information is not given out by mail or telephone.

Student Health Service

Under the University Health and Insurance Plan, students at the School of Public Health receive medical care and insurance toward hospital expenses. Medical care is provided through the facilities of the Medical Area Health Service, located in Vanderbilt Hall. The hospitalization insurance extends for a period of 12 months from September 1, and covers hospitalization in Boston and elsewhere. Non-degree, post-doctoral research and teaching fellows who are in a training status are required to enroll in the Student Health Plan unless they can show that they have comparable coverage.

In addition, a prepaid program for spouses (including maternity benefits) and children of full-time students is available. As the plan provides extensive benefits for ambulatory and inpatient care, all who are eligible are strongly advised to enroll. Its coverage, like that of the Student Plan, extends for a period of 12 months from September 1, and provides full semiprivate hospitalization benefits. A descriptive brochure about the plan for dependents is sent to students before registration or may be obtained from the Registrar.

Any illness necessitating absence from classes should be reported to the Medical Area Health Service Office by the student or an attending physician, and to the Associate Dean of Student Affairs at the School. A physician from the Medical Area Health Service, on call twenty-four hours a day, can be reached through the switchboard of Harvard University.

For further information, contact the Director, Medical Area Health Service, 275 Longwood Avenue, Boston, Massachusetts 02115. Telephone: (617) 732-1370.

Fellowships and Loans

The Harvard School of Public Health is a participant in the Harvard University Federally Insured Student Loan Program. This program permits a student who either is a U.S. citizen or has immigrant status to borrow up to \$5,000 a year, providing the student has less than \$15,000 in outstanding loans.

Some fellowship support is available through departments and special programs from federal and nonfederal sources for qualified students in a variety of fields. In addition, there are limited amounts of funds available under the National Direct Student Loan and University Work Study programs.

As a matter of policy, the Harvard School of Public Health does not discriminate among applicants and students in fellowship and loan programs on the basis of race, religion, sex, national origin, color, creed, handicap, or age.

Detailed information about fellowships and loans can be obtained by writing to Ms. Margaret C. Salmon, Director of Financial Aid, Harvard School of Public Health, 677 Huntington Avenue, Boston, Massachusetts 02115.

Scholarships

The Committee on General Scholarships and the Sheldon Fund administers a number of scholarships which are open to applicants from all Schools of the University. These include Travelling Fellowships, Restricted and Unrestricted Scholarships. Eligibility for many of these funds is very specific and varies according to terms of donors. Nomination for these scholarships must be made by the Director of Financial Aid. For a complete list of University Scholarships, applicants should consult the General Catalogue Issue of Harvard University.

Some awards are made available through departments or the Financial Aid Office and are based on scholastic achievement. One example is the John E. Thayer Scholarship which is the Bequest of John E. Thayer, the income to be paid "to the ten most meritorius scholars in Harvard University every year — the income shall only be paid to such meritorious scholars as who actually need the same." This award is determined by the Committee on Financial Aid following the first semester of each academic year. The award is based on a review of the grade cards of students who have elected the ordinal grading system and a needs analysis based on financial records on file in the Office of Financial Aid.

Office of Student Affairs

The Office of Student Affairs is concerned with many aspects of student life. The staff works with other groups and individuals to identify the special needs of students, plan and direct orientation, publish the student handbook and a weekly newsletter, and coordinate social events. Student recruitment activities are coordinated by staff in this Office. Up-to-date information is maintained on housing, child-care facilities, transportation, and athletic outlets in the Medical Area, Boston, and Cambridge.

The Director of Counseling offers career, personal and educational counseling and maintains a resource center containing job listings. The Office contacts potential employers to acquaint them with programs at the School and to request information about job openings. Current positions (permanent, summer, and part-time) are posted. Students are assisted in writing resumes, arranging for interviews, and exploring career opportunities. The Office's activities complement the efforts of departments, programs, and faculty advisers. Data collected about positions and salaries of graduates are available to prospective students.

Further information can be obtained from the Associate Dean of Student Affairs, Harvard School of Public Health, Room G-4, 677 Huntington Avenue, Boston, Massachusetts 02115.

Protection of Rights and Privacy of Students

The School of Public Health has adopted policies and procedures in compliance with The Family Education Rights and Privacy Act of 1974, which is commonly referred to as "the Buckley Amendment." Copies may be obtained from the Registrar's Office, Room G-4, 677 Huntington Avenue.

The Buckley Amendment was designed to protect the privacy of student educational records, afford students and former students the right to inspect the records that directly concern them, and provide students and former students the right to question and challenge the content of their educational records through formal hearings.

If a student believes that the School has failed to comply with the provisions of this amendment, or of the implementing regulations, he or she may file a complaint with The Family Education Rights and Privacy Act Office, the Department of Health, Education, and Welfare, Washington, D.C.

The School annually publishes a student directory with the names of students, their pictures, countries of residence, degrees and years received, colleges and universities attended, programs of concentration, and local addresses. Any student not wishing any of this information included in the directory should inform the Admissions Office (if a new student) in his or her acceptance letter or the Registrar (if a continuing student) by letter. This written notification must be received by these offices no later than four weeks preceding the start of the fall term.

Academic Integrity

The School expects its members to maintain high standards of ethical conduct and personal integrity, and to refrain from any form of cheating or plagiarism. This code governs examinations, term papers, and all other aspects of graduate student performance. In addition, the School expects students to abide by the laws of the Commonwealth of Massachusetts and the United States of America. Any violation of these standards of ethical behavior constitutes potential grounds for expulsion from the School.

Alumni Association

The School's Alumni Association has a membership of approximately 3,200 graduates located throughout the world. The Association is governed by an elected Council which meets twice a year, once in the fall at the APHA annual meeting, and once in the spring at the School. The Association publishes the *Alumni Bulletin* twice a year, to inform members of activities at the School and to exchange news of classmates. In 1977 the Association began fund raising for the Margaret Dale Penrose Scholarship Fund to provide financial assistance to needy students. For information about alumni activities, contact the Associate Dean for Student and Alumni Affairs.

Courses of Instruction

In the course listings, course numbers from 100 to 199 indicate undergraduate and graduate courses; numbers from 200 to 299 indicate primarily graduate courses; and numbers from 300 to 399 indicate graduate courses of reading and research.

The letters "a," "b," "c," "d," and "e" following the course number indicate the period(s) in which a course is given, with "a" denoting first period and "b" second period (fall); "c" third period and "d" fourth period (spring). The letter "e" indicates supervised special studies or field observations, usually during the one-week period between fall and spring terms or during the post-class period following the spring term.

The credit assignment is given in units following the statement of number and length of sessions per week. Course titles in bold type are often followed by titles and numbers in roman face (enclosed in parentheses). This indicates that the course is also listed in other Harvard catalogs, namely, Arts and Sciences, and that the course credit is provided through that faculty as well as through the School of Public Health, e.g., **MCHA-BEH 237c,d** (E-P220), **POP 185 a,b** (Sociology 185) **EHS 264c,d** (Engineering 283).

Interdepartmental Courses

ID 201b. Historical Analysis of Public Health Policy and Practice: United States, 1900-1975

Lectures, section meetings. *Two 1½-hour sessions each week. 2.5 units.* Dr. Rosenkrantz. Not given 1979-80.

Identifies six issues to illustrate the relationship between social experience and professional responsibility for prevention of disease. Topics selected for analysis based on historical example illustrate policy-related issues: how health hazards are identified; determinants of resources; criteria of efficacy and equity in policy and services. Recommended for students who wish to relate their special competence to the network of objectives in public health.

ID 209a,b. Health Services in Developing Countries

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Wray, Dr. Cash.

Provides a broad overview of health and health care problems in developing countries. Central issues include: ecologic, environmental, and other characteristics of developing countries affecting health; analysis of their health problems, the alternative approaches to solving them, the policy and planning issues in applying solutions, and the organizational alternatives for utilizing health resources; the nature, composition, and training of the health team for use at the local and district levels; and the relation of health to development and the position of health in national planning priorities. Preference given to students who have previously been involved in international health activities.

ID 212c. Biomedical Writing

Seminars. *One 2-hour session each week. 2 units.* Dr. Chemin.

Writing scientific papers is an integral part of the research process. This course develops practical skills and experience in planning and writing articles that meet the editorial demands of biomedical journals. The salient elements of a well-prepared article — logical organization, clear and concise scientific prose, and understandable tables and figures — are emphasized by criticizing short papers written by the participants on biomedical subjects of their own choice.

Enrollment limited to 10 students and requires advance approval of the instructor.

ID 215c,d. Environmental Health Evaluation and Management

Seminars, lectures. *Two 1½-hour sessions each week; additional computational sessions to be arranged. 5 units.* Dr. Harrington.

Introduces concepts and analytical methods for the quantitative evaluation and management of man's environment. Topics include: the development of natural resources, resulting environmental conditions, and effects on human health. Where appropriate, mathematical models are developed and critiqued in a systems analysis framework. Students are required to submit a term project.

A strong background in college-level mathematics is assumed.

ID 217c,d. Capitalism, Socialism, and Public Health

Lectures, seminars. *One 2-hour session each week. 2.5 units.* Dr. Lewontin, Visiting Lecturers.

Not given 1979-80.

General course contrasting the analysis of problems in public health, nutrition, and population by Marxist and capitalistic social and economic theories. Topics include: Marxist economics and social theory, population control, "green revolution," nutrition planning, maternal and child health, and occupational health.

ID 220c,d. A Case Study in Integrated Planning

(Economics 2730, Education A885, Planning 281)

Lectures, seminars. *Two 2-hour sessions each week. 5 units.* Dr. Cash, Dr. Noel McGinn (Lecturer in Education, Graduate School of Education), Dr. Michael Roemer (Lecturer in Economics, HIID), Dr. Donald Snodgrass (Lecturer in Economics, HIID), Dr. Brian Berry (Professor of City/Regional Planning, Graduate School of Design).

This seminar brings together students and faculty from the Graduate Schools of Public Health, Design, Education, Arts and Sciences (Economics), and from the Harvard Institute for International Development, to write a development plan for a specific geopolitical area of a developing country. This development planning problem is derived from an ongoing HIID project and emphasizes an inter-disciplinary team approach to problem solving and planning.

Enrollment subject to approval of the instructor.

Behavioral Sciences

POP-BEH 130a,b. The American Household in Demographic Perspective

Lectures. *Two 1½-hour sessions each week. 5 units.* Dr. Masnick.
(Course described under Population Sciences.)

BEH 201a. Health and Behavior

Lectures, discussions. *Three 1-hour sessions each week. 2.5 units.* Dr. Radius.
Considers behavioral science literature and variables as they contribute to our understanding of relationships between an individual's behavior and his/her health status. Attitudinal and sociodemographic predictors of various preventive health activities, as well as those linked to specific disease states will be reviewed. Also considered are methodological problems in pertinent research.

BEH 204c, 204d. Psychiatric Epidemiology: Problems, Concepts, and Methods

Seminars. *One 3-hour session each week. 2.5 units each period.* Dr. Wechsler.
Introduces students to the field of psychiatric epidemiology. The emphasis in the "c" period is on studies of major psychoses such as schizophrenia using data obtained from psychiatric treatment services and institutions. In the "d" period, emphasis is given to the assessment of mental health in total populations through field surveys.

Prereq. EPI 201a, BIO 101a,b, or permission of the instructor. It is recommended that students take both periods.

BEH 207b. Sociological Perspectives in the Study of Health Attitudes and Behaviors

Lectures, seminars. *Two 1½-hour sessions each week. 2.5 units.* Dr. Radius.
Examines the sociological literature on consumer attitudes, sick-role behavior, prevention, and illness. Also considers methodological issues specific to this substantive area.
Prereq. Introductory sociology or equivalent, or permission of the instructor.

BEH 208c,d. Drug Abuse

Seminars, discussions. *Two 1½-hour sessions each week. 5 units.* Dr. McAuliffe.
Covers epidemiology, diffusion of drug use among peer groups, public policy, strategies of treatment and prevention, drug effects on maternal and child health, program planning and

administration, deviant careers of addicts, social control, and community responses to sociomedical problems.

BEH 210d. Inducing Social Change

Seminars. *Two 1½-hour sessions each week. 2.5 units.* Dr. Mertens.

Designed for various specialists in public health who are charged with responsibility for introducing changes in organizations and communities. The subject matter includes methods and theories of teaching, principles of individual and group psychotherapy, approaches to sensitivity training and group dynamics, and organizational theory. Techniques and procedures illustrating these theories are presented through readings, discussions, and case illustrations.

BEH 211d. Psychiatric Problems in Organizations and Industry

Lectures, readings, case illustrations. *One 2-hour session each week. 2.5 units.* Dr. Mertens.
Designed to provide basic information relevant to clinical and case management in industrial and other organizational settings. It analyzes research and clinical findings in such a way as to prepare students to handle not only individual maladaptation, but also disintegration at the organizational level. It presents successively etiology and symptomatology of individual and group dysfunction and is designed for students who already have a basic knowledge of psychopathology.
Enrollment subject to approval of the instructor.

BEH 213c,d. Managing Human Resources: The Planning and Implementation of Intervention Programs

Lectures, discussions. *One 3-hour session each week. 5 units.* Dr. Benfari, Dr. McAlister.
Drawing heavily upon the applied behavioral sciences, this course is designed to provide future planners and managers in health care settings with knowledge and skills in designing and structuring organizations; planning and goal setting in complex environments; clarifying and allocating role responsibilities; making effective decisions; improving the effectiveness of teams; and managing inter-professional conflicts.

BEH 215a,b. Methods of Social Research: Design and Measurement

Seminars. *Two 1½-hour sessions each week. 5 units.* Dr. McAuliffe, Dr. Gortmaker.

Social research methods, including participant observation, social experiments, and surveys, are examined with respect to design and measurement. Topics discussed at an advanced level appropriate for students specializing in research and evaluation.
Prereq. Knowledge of statistics through multiple regression and two-way analysis of variance is assumed.

BEH 215c,d. Methods of Social Research: Data Collection and Analysis

Seminars. *Two 1½-hour sessions each week. 5 units.* Dr. Gortmaker, Dr. McAuliffe.
Topics include: sampling, data collection techniques, construction of questionnaires, interviewing, costs of data collection, computer processing of large data files, and selected topics in analysis of behavioral science data.
Prereq. BEH 215a,b, or permission of the instructor.

BEH 216b. Change of Health Behaviors

Lectures, discussions. *Two 2-hour sessions each week. 2.5 units.* Dr. McAlister.
Designed to provide students with practical research experience in health promotion. Content includes theories of behavior change and communication, as well as analysis of specific programs. Each student is assigned to a specific problem area for discussion and field work.
Prereq. Previous course work in social/behavioral sciences or relevant experience, and permission of the instructor.

MCHA-BEH 237c,d. Child Development and Social Policy (Education P-220)

Seminars. *Two 1½-hour sessions each week. 5 units.* Dr. Walker.
(Course described under Maternal and Child Health and Aging.)

BEH 300a,b,c,d,e. Tutorial Programs

Time and credit to be arranged. Staff of the Department.
Arrangements may be made with individual instructors to give a reading course on topics not covered in the Department's course offerings.

BEH 350. Research Training

Training in research is available through individual arrangements with the staff of the Department.

Biostatistics

BIO 101a,b. Principles of Biostatistics

Lectures. *Two 1-hour sessions each week.*

Laboratory. *One 3-hour session each week. 5 units.* Dr. Drolette.

Lectures and laboratory exercises acquaint the student with the basic concepts of biostatistics, their application and interpretation. Topics include: descriptive statistics, probability distributions, inference, tests of significance, association, and regression. Laboratory groups will be organized by areas of academic interest or specialization.

BIO 202c,d. Statistical Methods in Research

Lectures, discussions, laboratory. *Two 3-hour sessions each week. 5 units.* Dr. Watemau.

A continuation of BIO 101a,b; introduces the student to technical statistical procedures important in problems of laboratory and field research. Topics include: multiple regression, analysis of variance, analysis of categorical data and discriminant analysis. Much emphasis is placed on the analysis of data using Minitab.

Prereq. Basic preparation in statistics.

BIO 205c,d. Mathematical Foundations of Biostatistics

Lectures. *One 2-hour session each week. 2.5 units.* Dr. Drolette.

Material includes: mathematical descriptions of commonly used distributions; standard procedures for estimating the moments of a distribution; and mathematical foundations of statistical inference, including the Neyman-Pearson lemma, the likelihood ratio, the central limit theorem, power and Bayesian inference. Prereq. A course in elementary calculus.

HPM-BIO 206a,b,c. Statistical Methods for Health Policy and Management (formerly HSA-BIO 241a,b,c.)

Lectures. *Two 1½-hour sessions each week. 7.5 units.* Dr. Thibodeau.

(Course described under Health Policy and Management.)

BIO 207c,d. Survey Research Methods in Community Health

Lectures, discussions. *One 2-hour session each week. 2.5 units.* Staff of the Department.

Research design, sample selection, questionnaire construction, interviewing techniques, the reduction and interpretation of data, and

related facets of population survey investigations are covered. Focuses primarily on the application of survey methods to problems of health program planning and evaluation. Treatment of methodology is sufficiently broad to be suitable for students who are concerned with epidemiological, nutritional, or other types of survey research.

BIO-HPM 215c,d. Health Program Evaluation (formerly BIO-HSA 208c,d.)

Lectures, discussions. *One 2-hour session each week. 4 units.* Dr. Fuhrer.

Designed to increase the student's ability to understand the uses and limitations of methods employed to evaluate health programs. Provides an overview of the purposes and procedures of evaluation methods as applied to health programs. Sufficiently broad to be of interest to program administrators and to health program analysts.

BIO 210a,b. Advanced Topics in Biostatistics

Lectures, discussions. *One 2-hour session each week. 2.5 units.* Dr. Watemau, Dr. Thibodeau, Dr. Laird.

Offered primarily for doctoral students majoring in biostatistics or epidemiology, though other qualified students are welcome. Presents some recently developed data analytic techniques. Topics will be selected from among: robust estimation, applied multivariate methods, jackknifing, optimal design, cross-validation, predictive inference, fitting nonlinear models, empirical Bayes method, and incomplete data analysis.

This course may be combined with the Tutorial 310a,b.

Prereq. Permission of the instructor is required of students not majoring in biostatistics or epidemiology.

BIO 211c,d. Discrete Multivariate Analysis

Lectures, discussions. *One 2-hour session each week. 5 units.* Staff of the Department.

Deals with the use of log-linear models to describe multidimensional contingency tables. Emphasizes practical application rather than mathematical theory. Topics include: use of such models to determine when tables can be reduced in size without changing the relationships between variables, hypothesis testing, obtaining rates standardized for more than one underlying variable, and combining data sets from different sources.

Prereq. A statistics course which includes analysis of variance.

BIO 213b. Computing Principles and Methods

Lectures, discussions. *Two 1-hour sessions each week.*

Laboratory. *One 1½-hour session each week. 2.5 units.* Dr. Neff, Staff of the Health Sciences Computing Facility.

Among the principles and methods of computing and data processing included in the course are: programming, flow-charting, and the use of a statistical program package, a data base management system, and computer program libraries. Criteria for choosing among existing programs are delineated. Case studies used to illustrate methods of data collection, coding, and data reduction.

BIO 220c,d. Multivariate Analysis for Quantitative Data

Lectures, student presentations. *Two 1½-hour sessions each week. 5 units.* Dr. Hanley, Dr. Stanley.

Topics include: Hotelling's T^2 , principal component and factor analysis, discriminant functions, clustering, and canonical correlation, with some discussion of distribution theory and tests of hypotheses. Students will participate in the analysis of a data set.

Prereq. At least one statistics course beyond the level of BIO 101a,b, knowledge of matrices, and some familiarity with computer packages such as SPSS, BMD, or SAS.

BIO 240c,d. Design of Experiments (Statistics 140)

Lectures. *Two 1½-hour sessions each week. 5 units.* Dr. Zelen.

Given alternate years; 1979-80.

Examines general principles and practical difficulties in controlled experimentation. Topics include: introduction to randomization theory, methods for increasing precision, principal types of designs, mixed and random effects models, and variance component estimation. Intended for students with a primary interest in statistics and biostatistics and for students in the experimental sciences.

Prereq. One or more courses covering the basic concepts of distributions, expectations, samples, testing, estimation, regression, and analysis of variance.

HPM-BIO 216c. Analysis of Health and Medical Practices (Public Policy 290)

Lectures, discussions. *Two 1-hour sessions each week. 2.5 units.* Dr. Milton C. Weinstein (Associate Professor of Public Policy, John F. Kennedy School of Government).
(Course described under Health Policy and Management.)

BIO 251a,b. Data Analysis

Lectures, discussions. *Two 2-hour sessions each week. 5 units.* Dr. Schoenfeld.

Examples and case studies of applications of statistics to the biomedical sciences. Five major units consist of topics drawn from distribution-free methods, discrete data analysis, parametric procedures, least squares, and critiquing the biomedical literature. One- and two-sample problems, techniques of fitting straight lines, short-cut procedures, and the summarizing and reporting of data are included.

Prereq. A course in statistics or permission of the instructor.

BIO 261a,b. Theory of Biometry I

Lectures. *Two 1½-hour sessions each week. 5 units.* Dr. Zelen, Staff of the Department.

Discusses the theoretical basis of concepts and methodologies associated with bioassay, life tables, the general theory of survival distributions and censoring, competing risk models, and the planning of clinical trials. Material is drawn from recent literature.

Prereq. Statistics 111 or equivalent, or permission of the instructor.

BIO 262c,d. Theory of Biometry II

Lectures, discussions. *Two 1½-hour sessions each week. 5 units.* Staff of the Department.

A continuation of BIO 261a,b. Topics include: semi-Markov processes as models for disease processes; generalizations of the stable disease model, such as incidence, prevalence, and time in state; models of early disease detection; length-biased sampling; optimization and periodic screening; and cell kinetics and labeling techniques.

Prereq. BIO 261a,b.

BIO 263a,b. Regression and Analysis of Variance

Lectures. *Three 1-hour sessions each week. 5 units.* Dr. Begg.

Examines the methods of least squares and maximum likelihood as applied to linear statis-

tical models: multivariate regression, calibration, analysis of variance, and random effects models. Topics include the development of hypothesis testing, confidence intervals and Bayesian techniques. Exercises and examples emphasize medical applications.

Prereq. A course in statistics at the level of Statistics 110; familiarity with matrix algebra.

BIO 266c,d. Stochastic Processes in Medicine and Biology

Lectures, discussions. *Two 1½-hour sessions each week. 5 units.* Dr. Lagakos.

Given alternate years; 1980-81.

Discusses those areas of modern applied probability useful for model building in the biomedical sciences. Topics include: Poisson processes, birth and death processes, Markov chains and processes, renewal theory, compartment models, random walks and sequential analysis, and the theory of epidemics. Examples are drawn from the biomedical sciences.

Prereq. Statistics 111 or equivalent, or permission of the instructor.

BIO 271. Computer Programming

Lectures. *Two 2-hour sessions each week for the first two weeks of the "a" period.*

Laboratory. *10 hours each week for the first two weeks of the "a" period.* No credit is given for this course. Staff of the Department.

An intensive, non-credit short course in computer programming in the FORTRAN language. Students without previous exposure to this language develop a working proficiency in it. Provides minimal skills in computer programming necessary to enter subsequent computing courses in the biostatistics curriculum.

BIO 273a,b. Introduction to Computing

Lectures. *Two 1½-hour sessions each week.*

Laboratory. *One 2-hour session each week. 5 units.* Dr. Neff.

Introduces the fundamentals of computing, emphasizing algorithms, information flow, and the systematic design of programs in higher-level languages such as FORTRAN. Topics include: the structure of digital computers, programming languages, algorithm development and usage, systems of analysis, and systematic design of programs and computing systems.

Prereq. Previous programming experience, or concurrent enrollment in BIO 271.

BIO 274c,d. Statistical Computing

Lectures. *Two 1½-hour sessions each week.*

Laboratory. *One 1½-hour session each week. 5 units.* Dr. Pagano.

Enables students to understand, properly use, and possibly develop statistical algorithms or software. Topics are prompted by statistical procedures or biomedical applications, and include: computer arithmetic, error analysis, numerical techniques, equation solving, matrix operations, approximation and smoothing, optimization, and simulation modeling.

Prereq. BIO 273a,b or equivalent, or permission of the instructor.

BIO 275a,b. Applied Data Management

Lectures, demonstrations. *Two 1½-hour sessions each week.*

Laboratory. *One 1½-hour session each week. 5 units.* Dr. Costello.

Introduces management of data, both external and internal, to computer data bases, concepts and techniques for handling data before it is ready for analysis, and practical aspects of computer data base design and usage. Topics include: data collection, forms and coding, data entry systems, quality control, data base structures (both logical and physical), data base management systems, file organization, and data models.

Prereq. BIO 273a,b or equivalent, or permission of the instructor.

BIO 310-315a,b,c,d. Tutorial Programs

Time and credit to be arranged. Staff of the Department.

An opportunity for tutorial work at the master's level is offered for interested and qualified students or small groups of students. Arrangements must be made with individual faculty members and are limited by the amount of faculty time available. These programs are open to students specializing in biostatistics and also to students in other fields who wish to go beyond the content of the regular courses. Six broad categories of this tutorial instruction are identified by the six course numbers below.

310 Statistical Methods

Guided study in specific areas of statistical methodology and application.

311 Teaching

Work with the Department in laboratory instruction and the development of teaching materials.

- 312 *Consultation*
Work with members of the Department on current statistical consultation activities.
- 313 *Computing*
Guided study in scientific programming, numerical methods, and data management.
- 314 *Study Design*
Guidance in developing statistical design of a study in which the student has a particular interest.
- 315 *Data Analysis*
Guidance in the statistical analysis of a body of data in which the student is interested.

Students may register for BIO 310-315 for a maximum of five credit units in the summer term.

BIO 350. Research

Candidates for the Doctor of Public Health, Doctor of Science, or other doctoral degrees may arrange for individual research. The work may be part of the program for a doctorate in this Department or may be integrated with doctoral research in other departments.

Attention is directed to EPI 202b, 203c, 204d, and 205c,d, courses of interest to biostatistics students, descriptions of which are found under Epidemiology.

Environmental Health Interdepartmental Courses

The following courses are conducted by the faculty and staff of the Kresge Center for Environmental Health, which includes the Departments of Environmental Health Sciences, Physiology, Sanitary Engineering, and the Occupational Health Program.

EHI 201a,201b. Principles of Environmental Health

Lectures. *Two 1-hour and one 2-hour sessions each week. 5 units.* Dr. Moeller.

Reviews the more important environmental health problems facing society. Topics in the "a" period include: radiation protection, air pollution control, occupational health, and environmental physiology and toxicology. Topics in the "b" period include: basic sanitation, water purification, waste-water treatment, traumatic injuries, environmental law and economics, and the health implications of energy use. A term paper is required.

Note: This course will be repeated in the spring semester.

Required for students in the M.P.H Program and recommended for students in the Department of Environmental Health Sciences.

EHI 204a,b. Human Factors in Occupational Performance and Safety

Lectures, demonstrations. *One 2-hour session each week. 2 units.* Dr. Snook.

Emphasizes the design of the job to fit the worker. Specific problems are investigated which result from the nature of the job itself, e.g., low back injuries, fatigue, hand disorders, slips and falls, human error, and psychological stress. The physiological, psychological, and anatomical characteristics of the worker are considered in the development of good job design principles.

EHI 205a,b. Current Topics in Occupational Health and Safety

Seminars. *One 1-hour session each week. 1 unit.* Dr. Peters, Staff of the Kresge Center, Visiting Lecturers.

Weekly seminars presented by faculty or guests involved with occupational health and safety problems. The purpose is to introduce students concentrating in occupational safety and health (including industrial hygiene) to

the field. The seminars cover technical as well as policy issues.

This course will be given pass/fail.

EHI 206a,b. Occupational Medical Clinics

Lectures, clinics. *One 2-hour session each week. 2 units.* Dr. Fine, Dr. Murphy.

Reviews the diagnostic techniques used by clinicians to detect and screen for a variety of occupational diseases, such as silicosis, contact dermatitis, and lead poisoning. The clinical syndromes of common occupational diseases are considered. The clinics are limited to physicians.

Enrollment subject to approval of the instructor.

EHI 207c,d. Policy Issues in Occupational Health

Seminars. *Two 1½-hour sessions each week. 5 units.* Dr. Boden.

Examines the legal, economic, and political foundations of occupational health activities in the United States. Enables students to develop the knowledge and skills in the above areas necessary to apply medical, industrial hygiene, and statistical skills to achieve a healthful workplace. The roles of government, unions, corporations, and research organizations are discussed.

EHI 209c,d. Mathematical Modeling for Health Sciences

Lectures, discussions. *Three 1-hour sessions each week, "c" period; two 2-hour sessions each week, "d" period. 4 units.* Dr. Butler.

A range of models for the space and time dependence of the key variables in natural systems is discussed. Specific applications emphasize processes that characterize the response of the organism to its environment. The inverse problem of using measurements to infer estimates of parameters of models is developed.

Prereq. Calculus, PHY 203a,b, and statistics to the level of concurrent enrollment in BIO 202c,d, 205c,d, or 210a,b.

EHI 211a,b. Critical Review of the Scientific Basis for Occupational Standards

Seminars. *One 2-hour and one 1-hour session each week. 5 units.* Dr. Wegman, Dr. Peters.

Designed to provide students with the opportunity to review the scientific basis for the association of selected occupational exposures

with disease. Special emphasis is placed on critical evaluations of the literature. Reviews occupational cancer and respiratory disease, pathophysiology of respiratory disease and epidemiologic approaches to chemical carcinogenesis. Attention will be directed specifically to the interface of science and regulatory standards.

Enrollment limited to 15.

Prereq. EPI 201a, BIO 101a,b, EHI 251c,d, or permission of the instructors.

EHI 251c,d. Basic Problems in Occupational Health and Industrial Environments
(Engineering 282)

Lectures. *Two 2-hour sessions each week.*

Laboratory demonstrations, field trips. *One 3-hour session each week. 5 units.* Dr. Ferris, Dr. Peters, Mr. Burgess, Dr. Smith, Dr. Wegman. Lectures, laboratory demonstrations, and inspections of workplaces show the relation of working conditions to health, with special reference to the recognition, measurement, and control of hazards. Examples include adverse conditions of temperature, humidity, radiation, and chemical and physical irritants. Particular emphasis is given to the prevention, diagnosis, and treatment of industrial disability and disease, and to workmen's compensation.

Prereq. PHY 203a,b.

EHI 254b. Introduction to Industrial Hygiene

Lectures, seminars, laboratories. *One 2-hour session each week. 1.25 units.* Mr. Burgess, Dr. Smith.

Intended for physicians, nurses, and other health professionals who will work with industrial hygienists in a variety of settings. Designed to familiarize these professionals with the methods used by the industrial hygienist in the prevention of occupational disease, thereby promoting a more effective working relationship. Topics include: the physical form of air contaminants, air sampling and analysis, engineering controls, and the preparation of survey protocols.

EHI 330e. Field Work

One-week period between fall and spring terms. 1 unit.

A week of supervised field observation is offered to students who may choose appropriate visits to medical or industrial hygiene departments of industries, airports, and other agencies which have operations or research in the field of environmental health. Field work arrangements are generally made early in the fall term.

Environmental Health Sciences

EHS 202a,b. Departmental Seminars

Seminars. *One 1-hour session each week. 1 unit.* Dr. Cooper.

Members of the Department present for discussion aspects of their current research in the "a" period; speakers from outside the Department present topics relating to the environment in the "b" period.

EHS 202c, 202d. Departmental Seminars

Seminars. *One 2-hour session each week. 1 unit* "c" period, 1.5 units "d" period. Dr. Spengler.

In the "c" period, second-year master and doctoral students report on their research in progress. In the "d" period, issues and conflicts in environmental management are presented through simulations and case studies.

EHS 211a,b. Introduction to Environmental Health Management

Lectures, seminars. *Two 2-hour sessions each week. 5 units.* Dr. Cooper.

Focuses on quantitative and descriptive methods that can aid in decision making relative to environmental health management. Techniques such as forecasting, modeling, cost/benefit analysis, optimization, and quality control reviewed in terms of their application to the determination and implementation of environmental policies. Emphasizes models and mathematical analyses applied to specific problems.

EHS 252a. Environmental Control: Industrial Ventilation (Engineering 280)

Lectures. *Two 1-hour sessions each week.*

Laboratory. *One 3-hour session each week. 2.5 units.* Mr. Burgess.

Intended for industrial hygiene and air pollution students. Covers the design and evaluation of local exhaust ventilation systems for the control of toxic air contaminants released into the workplace by industrial operations and processes.

EHS 252b. Noise and Vibration Control
(Engineering 280)

Lectures. *Two 1-hour sessions each week.*

Laboratory. *Four 3-hour sessions. 2.5 units.* Dr. Cudworth, Mr. Cavanaugh (Consultant in Acoustics).

Introduces the fundamentals of sound and vibration generation, transmission, and recep-

tion. Emphasizes the control of environmental noise hazards in industrial workplaces. Basic measurement instrumentation and techniques will be introduced with practical exercises. Noise hazard control methodology will be explored by means of lectures, demonstrations, and field trips to laboratories and industrial plants.

EHS 253a,b. Aerosol Technology (Engineering 286)

Lectures. *Two 1-hour sessions each week.*

Laboratory. *One 2-hour session each week. "a" period; one 4-hour session each week, "b" period. 5 units.* Dr. Hinds.

Covers the properties of suspended particulate matter (dust, smoke, clouds) and the physical principles underlying its behavior. Topics include: particle motion due to gravitational, thermal, and electrostatic forces; diffusion; impaction; coagulation; filtration; condensation and evaporation; optical properties; and sizing statistics. Laboratories cover optical and electron microscopy, sampling, and mass concentration and particle size measurement. Required for concentrators in industrial hygiene and air pollution control.

EHS 261a,b. Community Air Pollution (Engineering 284)

Lectures, seminars. *Two 2-hour sessions each week. 5 units.* Dr. First, Dr. Leith.

Measurement and control of community air pollution; pollutant dispersion; air quality standards; health effects; damage to animals, plants, and property; community and site surveys; the legal and enforcement aspects of air pollution control; the nature and quantity of atmospheric emissions from vehicles, incinerators, and specific industries.

Prereq. A working knowledge of chemistry.

EHS 262c. Meteorological Aspects of Air Pollution (Engineering 285)

Lectures, seminars. *Two 2-hour sessions each week. 2.5 units.* Dr. Spengler.

Provides the student with a general understanding of the present status of local and long-range dispersion modeling. Also presents an evaluation of the meteorological factors associated with the transport, transformation, dispersion, and removal of air pollutants. Students will learn to recognize and define the parameters of elements in the atmosphere affecting pollutant dispersion and to calculate

concentration fields downwind of pollutant sources.

Prereq. Knowledge of calculus.

EHS 264c,d. Identification and Measurement of Air Contaminants (Engineering 283)

Lectures. *Two 1-hour sessions each week.*

Laboratory. *One 3-hour session each week. 5 units.* Dr. Smith, Staff of the Department.

Emphasizes sampling and analytical methods for air contaminants plus related subjects. Included are: chemical and instrumental methods of air analysis, isokinetic sampling, biological and solvent analysis, radioactive aerosol determinations, air pollution surveys, and fire and explosion evaluations.

Required for concentrators in industrial hygiene and air pollution control and for students in the radiological health and the Master of Industrial Health programs.

EHS 265c,d. Air and Gas Cleaning (Engineering 289)

Lectures. *One 2-hour session each week.*

Laboratory. *One 2-hour session each week. 5 units.* Dr. Leith, Dr. First, Staff of the Department.

Covers theory, selection, application, and testing of air and gas cleaning devices, including: particle collection by inertial and centrifugal force, gas absorption in liquids and adsorption on solids, gas incineration, and basic processes of particle conditioning. Laboratory experiments and case studies illustrate important aspects of sizing and correct selection of equipment.

Prereq. EHS 253a,b and previous or concurrent enrollment in EHS 264c,d.

EHS 271a,b. Introduction to Radiation Protection (Engineering 288)

Lectures, demonstrations. *One 2-hour and one 1-hour session each week. 5 units.* Dr. Shapiro, Dr. Moeller.

Covers laboratory, industrial, and environmental sources of radiation; the interaction of ionizing particles with matter; the concept of radiation dose from external and internal sources; radiation measurements; radiation protection standards and regulations; and methods of environmental and occupational radiation protection. (Students desiring laboratory experience in the use of radiation measuring instruments should enroll concurrently in EHS 272b.)

EHS 272b. Introduction to Radiation Instrumentation

Laboratory. *One 2-hour session each week. 1.25 units.* Dr. Shapiro.

Provides an introduction to the use of radiation measuring equipment and supplements the material presented in EHS 271a,b. Exercises cover radiation counting, gamma spectroscopy, and the use and calibration of radiation survey instruments. (This course is available to students in EHS 271a,b who desire laboratory experience in the use of radiation measuring instruments.)

Enrollment limited and subject to approval of the instructor.

Prereq. Previous or concurrent enrollment in EHS 271a,b.

EHS 273c,d. Advanced Topics in Radiation Protection

Lectures, discussions. *One 2-hour session each week. 2.5 units.* Dr. Moeller, Dr. Shapiro.

Involves detailed study of current handbooks and publications related to radiation protection. Areas covered include the regulation of radiation use and the evaluation and control of radiation hazards. Specific topics include: regulatory guides and standards; radiation shielding with emphasis on neutrons; protection against internal emitters; and the control of radioactive contamination.

Prereq. EHS 271a,b and permission of the instructors.

EHS 274c. X-ray Protection

Lectures. *One 2-hour and one 1-hour session each week.*

Laboratory. *One 3-hour session each week. Time to be arranged. 2.5 units.* Dr. Webster.

Given alternate years; 1980-81.

Covers the fundamentals of X-ray equipment (both industrial and medical), the design of X-ray installations, and the procedures for radiation protection surveys and inspections, and includes several problem assignments. Considerations include: equipment and room design, with emphasis on items such as leakage; collimation; filtration; primary and secondary barriers; workload; and protection of patients.

Prereq. EHS 271a,b.

EHS 281a. Introduction to Physics of Diagnostic Radiology

Lectures. *Two 2-hour sessions each week. 2.5 units.* Dr. Philip Judy.

Given alternate years; 1979-80.

For students in medical physics and radiological health. Covers the fundamentals of diagnostic radiology, including diagnostic criteria, such as abnormal size, position, motion, or structure; principles of specific studies, e.g., cardiac angiography; and the use of contrast media. Reviews principles of equipment employed, such as diagnostic X-ray sources, recording systems, film, screens and image intensifiers, and factors affecting image quality and patient exposure.

EHS 282b. Introduction to Physics of Nuclear Medicine

Lectures. *Two 2-hour sessions each week. 2.5 units.* Dr. Bjarngard, Mr. Zimmerman.

Given alternate years; 1979-80.

Production and properties of radionuclides and radiopharmaceuticals, as well as the physiological basis for medical applications, form the foundation for this course for students in medical physics and radiological health. Principles of specific studies are presented (e.g., uptake measurements, tracer kinetics, static and dynamic imaging and *in vitro* techniques). Instrumentation and factors affecting accuracy, image quality, and patient exposure are also discussed.

Note: Mr. Zimmerman is the principal instructor for this course.

EHS 283a. Introduction to Physics of Radiation Therapy

Lectures. *Two 2-hour sessions each week. 2.5 units.* Dr. Svensson (Associate Professor of Radiation Therapy, Harvard Medical School).

Given alternate years; 1980-81.

For students in medical physics, reviews tumors of different primary sites and their histology and routes of spread. Various aspects of radiation therapy are discussed, including time-dose relationships, influence of oxygen and chemical agents, tumor localization, treatment planning, and simulation. Also covered are treatment with external beams, radioactive isotopes, implants and intercalary sources; dose calculations; and machine specifications and designs.

EHS 284c,d. Physics of Diagnostic Radiology

Lectures. *One 2-hour and one 1-hour session each week.*

Laboratory. *One 3-hour session each week. 5 units.* Dr. Webster.

Given alternate years; 1979-80.

Deals with the physical and mathematical aspects of image formation, including: characteristics of diagnostic X-ray machines and recording systems; geometrical relationships; X-ray spectra; information limits; optical physiology and performance; special techniques, such as magnification and cine radiography; and computerized tomography. Radiation protection also covered, with an emphasis on patient dose.

EHS 285a,b. Physics of Nuclear Medicine

Lectures. *One 2-hour session each week.*

Laboratory. *One 3-hour session each week. 5 units.* Dr. Bjarngard, Mr. Zimmerman.

Given alternate years; 1980-81.

Covers the physical and chemical aspects of production, properties, and standardization of radionuclides and radiopharmaceuticals, including cyclotron production of short-lived isotopes. Also discussed are instrumentation (e.g., scanners, cameras, proportional counters, the positron camera) and computer applications involving dynamic and regional function analysis, radionuclide tomography, and image processing. The measurement of calcium in bone is also covered.

Note: Mr. Zimmerman is principal instructor for this course.

EHS 286c, 286d. Physics of Radiation Therapy

Lectures. *One 2-hour session each week.*

Laboratory. *One 3-hour session each week. 2.5 units each period.* Dr. Bjarngard.

Given alternate years; 1980-81.

Deals with the mathematics of treatment planning for external beams, brachytherapy and radioactive nuclides, including computerized techniques. Also covered are accurate and precise dosimetry measurements for photons, electrons, protons, and neutrons, including calibration and quality control of machines and sources. Selected studies of current clinical problems are also presented.

EHS 301-306a,b,c,d,e. Tutorial Programs

Reading or research. *Time and credit to be arranged.*

Reading or research assignments for individual tutorial work at a master's degree level are provided for qualified students in the fields of industrial hygiene, industrial ventilation, aerosol technology, radiological health, medical radiation physics, nuclear medicine, solid waste management, air pollution control, and environmental health management.

301 Air Pollution

Dr. Cooper, Dr. First, Dr. Leith, Dr. Spengler.

302 Industrial Hygiene

Mr. Burgess, Dr. Hinds, Dr. Smith.

303 Radiological Health

Dr. Moeller, Dr. Shapiro.

304 Medical Physics

Dr. Bjarngard, Dr. Webster.

305 Solid Wastes

Dr. First.

306 Environmental Health Management

Dr. Cooper, Dr. Moeller.

Enrollment subject to approval of the Head of the Department.

EHS 350-360. Research

Facilities of the Department are available for doctoral candidates and properly qualified second-year master's degree students to pursue independent research on problems in industrial hygiene, aerosol technology, solid waste management, air pollution control, and radiological health. Areas currently receiving study in the Department are as follows:

351 Dr. Smith

Evaluation of performance factors of respiratory protective devices; monitoring exposures of occupational groups to toxic air contaminants; ventilation control of airborne contaminants; evaluation and control of noise.

352 Dr. First, Dr. Leith

Application of gas- and liquid-phase reactions to particulate and gas removal; development and design of cleanup systems for airborne contaminants from industrial and nuclear power plant facilities; incineration of solid wastes including municipal, radioactive, biological, and laboratory materials.

- 353 Dr. Leith
Measuring and modeling the performance of industrial gas cleaning equipment; assessing the air pollution potential of simple and complex pollution sources.
- 354 Dr. Spengler
Computer modeling of pollutant transport in urban atmospheres; analysis of air quality data derived from sampling networks; meteorology of urban areas.
- 355 Dr. Cooper
Experimental and theoretical research in aerosol generation, measurement, behavior, and control; quantitative methods of environmental management.
- 356 Dr. Moeller
Reduction of population dose from sources of natural origin; environmental protection for nuclear facilities; radiation safety criteria and standards.
- 357 Dr. Hinds
Sampling and analysis of aerosol particles both in the ambient atmosphere and under laboratory conditions; generation of monodisperse aerosols; uses of aerosols in environmental health; development of particulate removal equipment.
- 358 Dr. Shapiro
Evaluation and control of hazards from radioactive contamination; radiation dosimetry.
- 359 Dr. Bjarngard
Medical radiation physics with emphasis on dosimetry, nuclear medicine, and radiation therapy.
- 360 Dr. Webster
Medical radiation physics with emphasis on survey techniques, instrumentation, and image quality and patient dose reduction in diagnostic radiology.
- Enrollment subject to approval of the Head of the Department.

The following courses, offered in the Harvard Faculties of Arts and Sciences and Government, and at the Massachusetts Institute of Technology, are open to qualified students from the School of Public Health and may be of interest to students of environmental health sciences.

Economics 1010a,c. Microeconomic Theory
Half course (*fall term*). M., W., (F.), at 11. Ericson.

Prereq. Elementary calculus.

Economics 1011a. Microeconomic Theory and Policy Analysis
Half course (*spring term*). M., W., F., at 11. Kresge.

Economics 1551. The Political Economy of Environmental Quality
Half course (*spring term*). M., W., F., at 12. Dorfman.

Prereq. Economics 10 or permission of instructor.

Natural Sciences 110. Automatic Computing
Half course (*fall term*). M., W., F., at 10. Bossert.

Natural Sciences 115. Models for Control of Man's Physical Environment
Half course (*fall term*). M., W., F., at 9. Harrington, Rogers.

Natural Sciences 134. Technological Assessment
Half course (*spring term*). Tu., Th., at 10 and occasional discussion hours to be arranged. Brooks.

Natural Sciences 145. Energy, the Environment, and Public Policy
Half course (*fall term*). Tu., Th., 9:30-11. Stauffer and Wilson.

M-111. Analysis for Decision Making
Half course (*spring term*). M, W., 8:30-10. Ludo Van der Heyden.

M-271. Law and Public Policy: Policy Analysis
To be given 1980-81. Hours to be announced. Roberts, Schelling.

S-482. Seminar: Science, Technology, and Public Policy
Half course (*spring term*). M., 2-4. Brooks, Cohen, Zinberg.

M.I.T. 1.143. Mathematical Optimization Techniques
Nine units (*fall term*). Tu., Th., 2:30-4. D. H. Marks.

M.I.T. 1.146. Engineering Systems Analysis
Nine units (*fall term*). Tu., Th., 10:30-12. DeNeufville *et al.*

M.I.T. 1.811. Environmental Law: Pollution Control
Nine units (*fall term*). Tu., Th., 4-5:30. Ashford and Owen.

M.I.T. 1.812J. Regulation of Health and the Environment: Selected Topics
Nine units (*spring term*). Hours to be arranged. Ashford.

M.I.T. 14.121. Microeconomic Theory
Six units (*fall term*). M., W., 10:30-12 (*first half term only*). McFadden *et al.*

M.I.T. 15.065. Decision Analysis
Nine units (*fall and spring terms*). Tu., Th., 10:30-12. Kaufman.

M.I.T. 15.081. Introduction to Mathematical Programming
Twelve units (*fall and spring terms*). Tu., Th., 2:30-4. Magnanti.

M.I.T. 22.37. Environmental Impact of Power Production
Twelve units (*spring term*). Not given 1979-80. Golay.

Epidemiology

EPI 201a. Introduction to Epidemiology

Lectures. *Two 2-hour sessions each week. 2.5 units.* Dr. Cole, Staff of the Department.

Lectures are supplemented by readings and exercises to familiarize students with epidemiologic concepts, especially those pertinent to the understanding and control of the chronic diseases.

EPI 202b. Principles of Epidemiology I: Elements of Study Design and Data Analysis

Lectures. *Two 2-hour sessions each week. 2.5 units.* Dr. Rothman.

For students at the master's level who wish to acquire a familiarity with epidemiologic methods. The principles of study design and data analysis are presented with examples and exercises. The emphasis is on practical rather than theoretical issues. May serve as an introduction to more advanced study or as a final course for those desiring a working familiarity with epidemiologic methods.

Prereq. EPI 201a or permission of the instructor.

EPI 203c. Principles of Epidemiology II: Problem Conceptualization and Study Design

Lectures, seminars. *Two 2-hour sessions each week. 4 units.* Dr. Miettinen.

With a detailed text providing background, the course utilizes simple examples and other illustrations to introduce the objects of epidemiologic research and the goals, options, and decision principles in study design. (Parallel tutorials are available for those desiring in-depth study.)

Prereq. EPI 202b or permission of the instructor.

EPI 204d. Principles of Epidemiology III: Data Analysis and Inference

Lectures, laboratory. *Two 2-hour sessions each week. 3 units.* Dr. Miettinen.

Again with a detailed text in the background, the course uses examples from actual studies to introduce the principles of hypothesis testing and estimation in epidemiologic research. (A parallel tutorial course is available for those desiring in-depth study.)

Prereq. BIO 101a,b, EPI 202b, or permission of the instructor.

EPI 205c,d. Practice of Epidemiology

Tutorials, seminars. *Tutorial sessions during "c" period; one 2-hour seminar each week during "d" period. 2.5 units.* Dr. Rothman.

The seminars consist of student presentations of plans for and analyses of epidemiologic data, with discussion by students and faculty. Preparatory work is done under tutorial arrangements with members of the faculty. For the analyses, the emphasis will be on conceptual issues and not on execution.

Prereq. EPI 202b and permission of the instructor.

EPI 206c,d. Topics in the Theory of Epidemiology

Lectures. *One 2-hour session each week. 2.5 units.* Dr. Hutchison, Staff of the Department.

For students who expect to conduct epidemiologic research. Consists of lectures on topics that are not part of the basic methodology covered in other courses in the Department. Topics include: sampling, factors affecting response, data handling, analysis of time-place clustering, cyclic variation, survival, and problems of distinguishing genetic and environmental components of a disease.

Prereq. EPI 201a and BIO 101a,b, or equivalent.

EPI 211c,211d. Epidemiology of Chronic Disease

Lectures. *One 2-hour session each week. 1.25 units each period.* Dr. Hutchison, Dr. Morrison.

A review of the epidemiology of chronic diseases. Consists of two modules, either or both of which may be elected. One module is given in each period. In the "c" period, the module is cancer and screening (Dr. Morrison); in the "d" period, cardiovascular and respiratory disease (Dr. Hutchison).

EPI 212c,d. Environmental Epidemiology

Lectures, seminars. *One 2-hour session each week. 2.5 units.* Dr. Monson.

This course has three objectives: (1) to review methods used in evaluating the health effects of physical and chemical agents in the environment, (2) to review available evidence on the health effects of such exposures, and (3) to consider policy questions raised by the scientific evidence. Includes lectures on methodology, seminars on the review and criticism of current literature, and presentations by outside experts on the evaluation and impact of epidemiologic data.

Prereq. EPI 201a and BIO 101a,b; EHI 201a, 201b recommended but not required.

EPI 300a,b,c,d,e. Tutorial Programs

Time and credit to be arranged.

Students may participate in departmental research in close association with a staff member. Time and credit are to be arranged with the Head of the Department.

EPI 350. Research

In selecting topics for research in doctoral programs, students should consider the fields in which members of the Department are currently working. These include:

Neoplastic Disease

Dr. MacMahon, Dr. Cole, Dr. Hutchison, Dr. Monson, Dr. Morrison.

Congenital Malformation

Dr. MacMahon, Dr. Miettinen, Dr. Rothman, Dr. Yen.

Cardiovascular Disease

Dr. Rothman, Dr. Miettinen.

Effects of Contraceptive Agents

Dr. Cole, Dr. Rothman.

Environmental Epidemiology

Dr. Monson.

Statistical Methods

Dr. Miettinen.

Health Policy and Management

HPM 101a,b,c. Economic Analysis (formerly HSA 250a,b,c.)

Lectures, seminars. *Two 2-hour sessions each week. 7.5 units.* Dr. Hemenway
Designed to bring students to an intermediate-level understanding of economic theory. Students will become familiar with economic approaches to problems and with microeconomic models and concepts, their uses and limitations.
Required for students in the Health Policy and Management Program.

HPM 201d. Health Economics (formerly HSA 252a,b.)

Lectures, discussions. *Two 2-hour sessions each week. 2.5 units.* Dr. Hemenway.
Examines the economic aspects of production, distribution, and organization of health services. Devoted to applying the framework of economic analysis to the health services sector. Topics normally include: the supply and demand of medical care facilities, markets for health manpower, financing of medical care, cost-benefit analysis, and problems of health planning.
Required for students in the Health Policy and Management Program.
Prereq. HPM 101a,b,c or equivalent or permission of instructor.

HPM 202c,d. Health Care Issues and Institutions

Lectures, discussions. *Two 2-hour sessions each week. 5 units.* Dr. Fineberg.
Describes major health care issues and the development and implementation of policies and programs which address those issues. Topics include: health manpower, ambulatory and hospital-based care, new medical technology, health care finance, and health planning and regulation. Readings include case studies and major writings in the field of health services research.
Required for students in the Health Policy and Management Program.

HPM 204a,b 204c,d. Administrative Systems (formerly HSA 260a,b,c,d.)

Lectures, seminars. *Three 1½-hour sessions each week. 5 units each semester.* Dr. Young, Ms. Barrett, Dr. Livernash, Dr. Trevelyan.
Examines issues related to managing health care organizations. Classes include: organiza-

tional theory, strategy, leadership, change and conflict, labor relations, financial accounting and analysis, cost accounting, and management control systems. Encourages students to take an administrative systems perspective, thereby viewing the managerial process in a more holistic way than is permitted by traditional functional analysis.
Required for students in the Health Policy and Management Program.
Prereq. HPM 204a,b or equivalent if HPM 204c,d taken separately.

HPM-BIO 206a,b,c. Statistical Methods for Health Policy and Management (formerly HSA-BIO 241a,b,c.)

Lectures. *Two 1½-hour sessions each week. 7.5 units.* Dr. Thibodeau.
An introduction to statistics and probability emphasizing their application in a variety of health policy and management contexts. Goals include establishing an awareness of basic statistical reasoning and recognition of common difficulties in application. Topics include: distributions, analysis of studies, inference (estimation and hypothesis testing), and applied regression analysis. Time-sharing computing will be used throughout.
Required for students in the Health Policy and Management Program.
Prereq. One college-level course in mathematics. Enrollment of students not in the Health Policy and Management Program subject to approval of the instructor.

HPM 208c. Quantitative Policy Analysis (formerly HSA 240c.)

Lectures, discussions. *Two 1½-hour sessions each week. 2.5 units.* Dr. Thompson.
The purpose is to provide students with motivation to analyze health problems quantitatively. Techniques include decision analysis and cost benefit analysis. Readings from health policy and management literature are used to illustrate the techniques and their limitations.
Required for students in the Health Policy and Management Program.
Prereq. HPM-BIO 206a,b,c or equivalent.

HPM 209d. Introduction to Operations Research (formerly HSA 240d.)

Lectures, discussions. *Two 1½-hour sessions each week. 2.5 units.* Staff of the Department.
Presents some of the basic models of operations research. Techniques includes linear programming, queueing theory, simulation, and

PERT/CPM. The purpose is to provide students with motivation to analyze health care problems quantitatively. Readings from health policy and management literature are used to illustrate the various techniques.
Required for students in the Health Policy and Management Program.
Prereq. HPM-BIO 206a,b,c or equivalent.

HPM 211b. Decision Analysis and Evaluation (formerly HSA 245b.)

Lectures, seminars. *Two 1½-hour sessions each week. 2.5 units.* Dr. Thompson.
Provides an overview of important, recent developments in decision analysis and their applications to clinical, policy, and evaluation problems in health. Emphasizes the appropriate use of analytic techniques for decision making, recognition of their short-comings and limitations, and their role in program evaluation. Topics include: preference curves, r-o-c curves, updating of probabilities, multi-attributable decision making, and multi-person decision making.
Prereq. HPM 208c.

BIO-HPM 215c,d. Health Program Evaluation (formerly BIO-HSA 208c,d.)

Lectures, discussions. *One 2-hour session each week. 4 units.* Dr. Fuhrer.
(Course described under Biostatistics.)

HPM-BIO 216c. Analysis of Health and Medical Practices (Public Policy 290) (formerly HSA-BIO 243c.)

Lectures, discussions. *Two 1-hour sessions each week. 2.5 units.* Dr. Milton C. Weinstein (Associate Professor of Public Policy, John F. Kennedy School of Government).
Concerns the analysis of clinical procedures and health programs, and examines uses and limitations of quantitative methods such as decision analysis and cost-benefit analysis. Topics include: resource allocation in the management of hypertension, treatment decision for acute abdominal pain, diagnosis of renovascular disease, screening for glaucoma, and coronary artery bypass surgery. Implications for quality assurance and medical reimbursement policies are considered.
Prereq. Some facility with quantitative methods, preferably with some elementary knowledge of statistics, decision analysis, or economics.

HPM 220c,d. Economics of Health Planning (formerly HSA 251c,d.)

Lectures, discussions. *Two 1½-hour sessions each week. 5 units.* Mr. Hsiao.

Applies economic analysis to planning of health programs. Application is emphasized over theory. Examines planning and regulation in a market economy and develops analytical tools, including systematic analysis, econometrics, modeling, simulation, and cost-benefit analysis. Planning topics include: health manpower, resource allocation, hospital facilities, and national health insurance. Skills in using analytical techniques appropriately are developed. Case study material used. Course especially appropriate for students who intend to pursue a career in planning and evaluation of health programs.

Prereq. One semester each of statistics and microeconomics.

HPM 221d. Seminar in Economics for Health Policy Analysis (formerly HSA 253d.)

Seminars. *One 3-hour session each week. 2.5 units.* Dr. Taylor.

Not given 1979-80.

Focuses on topics in the economics of health policy. Themes vary from year to year, but typically include: econometric models, the role of government in the health sector, analysis of government regulatory programs, the production of physicians' services, distributional aspects of national health insurance, and the market for blood in the United States.

Prereq. HPM 101a,b,c, HPM-BIO 206a,b,c or equivalent, and permission of the instructor.

HPM 225d. Health Care Operations Management (formerly HSA 261d.)

Lectures, case studies, discussions. *Two 1½-hour sessions each week. 2.5 units.* Staff of the Department.

The objective is to familiarize students with a variety of operating systems in a health care environment and to present significant issues related to the types of decision situations a health care manager faces in practice. Subjects include: labor productivity monitoring, resource management, information systems evaluation, materials management, nursing staffing, elective admissions scheduling, operating room scheduling, and hospital drug distribution systems.

Prereq. Basic course in statistics or quantitative methods, or permission of the instructor.

HPM 227d. Reimbursement Systems (formerly HSA 262d.)

Seminars. *One 3-hour session each week. 2.5 units.* Dr. Young.

Examines issues related to the general theme of third-party reimbursement for health care institutions. The principal focus is on hospitals. Issues include: cost containment efforts, hospital perspectives, and the role of incentives. Some specific systems are examined in detail in order to assess the feasibility of certain techniques and to address questions of overall reimbursement system design.

HPM 229d. Quality Assurance in Health Services (formerly HSA 206d.)

Lectures, discussions. *Two 2-hour sessions each week. 2.5 units.* Dr. Palmer, Visiting Lecturers. Examines issues in defining "quality in health care" and the choice of methods for assessing and improving quality of health care. Recent research is reviewed and currently operating programs, including PSROs, are analyzed. Presentation includes case materials from quality assurance programs in both hospital and ambulatory settings.

HPM 230e. Government and Private Funding for Research and Health Care Programs (formerly HSA 265e.)

Lectures, discussions, workshops. *To be arranged. 1 unit.* Staff of the Department.

To carry out research or develop needed health care programs, managers and policy analysts need to be able to obtain funding from federal, state, and local sources, and from foundations and corporations. This course aims to enable participants to demonstrate in a clear and concise proposal an understanding of the issues and facility with methodological design. Requirements for proper administration of funds are also discussed. Proposals are prepared and critiqued in the workshops.

Prereq. Exposure to research issues in health care or program development and permission of the instructor.

HPM 231d. Design and Implementation of Health Care Regulation (formerly HSA 209d.)

Seminars. *One 3-hour session each week. 2.5 units.* Dr. Feldman.

Analyzes the policy choices which are inherent in government programs intended to change the behavior of health care providers. Cases are drawn primarily from planning and regulatory

programs at the federal and state levels in the United States.

HPM 235a,b. Personnel and Labor Relations

Case discussions. *Two 2-hour sessions each week. 5 units.* Staff of the Department.

Utilizes cases plus a text and places approximately equal emphasis on union-management and personnel topics. Labor and personnel topics are integrated. Labor elements of the course emphasize the grievance, arbitration, and negotiation processes including a negotiation exercise. Personnel concentrates on intellectually challenging topics including social legislation. Available health care cases will be utilized.

HPM 240a,b,c,d. Applied Research Seminar (formerly HSA 270a,b,c,d.)

Seminars. *One 2-hour session each week.*

Field work. *One day each week. 10 units.* Staff of the Department.

Students will work on a specific problem in an operational setting under the guidance of both clinical and academic faculty members. In the seminar, faculty and preceptors from a variety of organizations discuss cases which relate thematically to the field work experiences. Two research reports required.

Required for students in the Health Policy and Management Program.

Prereq. Completion of the first year of the Health Policy and Management Program.

HPM 300a,b,c,d,e. Tutorials

Time and credit to be arranged.

Students may make individual arrangements to do work under the guidance of a member of the division. This work may include readings or special projects.

Health Services Administration

*HSA-HPM 201a,b. Administration of Health Services

Lectures, discussions, case studies. *Two 2-hour sessions each week. 5 units.* Dr. Yerby. Staff of the Department.

Examines the structural and functional characteristics and the sociology of health institutions and organizations, and environmental constraints such as resources, law and regulation, mandate, and societal expectations are examined. Management theory and practice, in the context of health services, emphasized in respect to organizational behavior, institutional strategy, financial management, management control and operations management. Law and the managerial role, including such issues as authority, liability and confidentiality are considered with particular reference to the social role of health services.

Required for students in the M.P.H. program.

HSA-HPM 203c,d. Administration of Personal Health Service Programs (formerly HSA 210c,d.)

Seminars, field projects. *One 2-hour session each week. 2 units.* Dr. Kasten.

Designed for students who will be administrators of personal health service programs. Inpatient, ambulatory, home, and rehabilitation programs are treated from an operational and preventive perspective. Special emphasis is placed on administrative problem solving. Students analyze administrative problems in operating personal care service programs. Enrollment subject to approval of the instructor.

HSA-HPM 205a,b. Economic Analysis for Public Health (formerly HSA 252a,b.)

Lectures, discussions. *Two 1½-hour sessions each week. 5 units.* Dr. Hemenway.

Provides an introduction to the basic principles of economics and economic analysis, particularly as they apply in the public health field. A systematic introduction to microeconomic theory includes the determinants of supply and demand, the theory of markets, and the concept of economic efficiency. In addition, attention is given to public expenditures and policy analysis.

HSA-HPM 207d. Planning in the Hospital Setting (formerly HSA 211d.)

Lectures, seminars. *Two 1½-hour sessions each week. 2.5 units.* Dr. Yerby, Ms. Bander.

Designed to acquaint students with the concepts and strategies of planning in the hospital setting. Offers practical understanding of the current status and potential application of organized planning efforts in the modern hospital. Environmental issues explored as well as the status of and outlook for multi-institutional planning endeavors. Special emphasis placed upon the perspective and approach of the organization.

Enrollment subject to approval of the instructors.

HSA-HPM-MCHA 212a,b. Human Rights in Health (formerly ID 208a,b.)

Lectures. *One 2-hour session each week. 3 units.* Dr. Curran.

Entails a comprehensive examination of human rights as they bear upon health programs, nationally and internationally. Among topics considered from ethical, cultural, and legal viewpoints are rights to medical care and a healthy environment, equality, rights of medical patients, women, children, and experimental subjects; and problems of balancing personal rights and community protection.

Enrollment limited. Auditing and convenience attendance not permitted.

HSA-HPM 213a. Issues in Geriatric Health Care

Lectures, seminars. *Two 2-hour sessions each week. 2.5 units.* Dr. Yerby, Dr. Avorn.

Uses a variety of public health perspectives to analyze the health needs of the elderly and services to meet them. Topics include: demographic background of the "graying" of America, normal and pathological aging processes, epidemiology of geriatric illness, design and administration of present alternative forms of long-term care, and cross-national perspectives.

HSA-HPM 214b. Ethics and Geriatric Policy

Lectures, seminars. *Two 2-hour sessions each week. 2.5 units.* Dr. Yerby, Dr. Avorn, Dr. Daniels (Associate Professor of Philosophy, Tufts University).

Examines, from an ethical viewpoint, various options in the planning and delivery of medical care, with particular reference to the elderly. Competing theories of distributive justice will be considered as they relate to Medicare and

various national health insurance proposals, planning and cost containment, resource allocation (macro and micro), and regulation. Also analyzes specific ethical dilemmas in the clinical care of the aged patient.

HSA-HPM 217a,b. Dental Public Health Practice (formerly HSA 232a,b.)

Seminars, field visits. *One 2-hour session each week. 2.5 units.* Dr. Yacovone.

Provides in-depth training in the administration and planning of dental health programs. Subjects include: community needs, resources, surveying, fluoridation, prepayment, and program evaluation. Each student develops a program plan in a specific area of community dental needs and presents the plan to the class.

HSA-HPM 218c,d. Dentistry and Social Policy (formerly HSA 233c,d.)

Lectures, seminars. *One 2-hour session each week. 2.5 units.* Dr. Yacovone.

Investigates relationships between the social sciences and dentistry. Subjects include: the role of the social sciences in dentistry, psychosocial interaction of doctor and patient, client perceptions of dentistry, interpersonal relationships in group practice, and the sociopolitical influence of dentistry as an organization.

HSA-HPM 220c,d. Health and Social Welfare Systems in Cross-National Perspective (formerly HSA 201b,c.)

Lectures, seminars, case discussions. *Two 2-hour sessions each week. 5 units.* Dr. Yerby, Dr. Dieter Koch-Weser (Associate Professor of Preventive and Social Medicine, Harvard Medical School).

Modernization and industrialization have affected the health and economic security of individuals and families. Cyclic unemployment, industrial accidents and disease, temporary and permanent disability, and the social and financial deficits of old age are among the problems of modern nation states. The course examines the mechanisms that have evolved in different societies to ameliorate these hazards. The interrelatedness of health and social welfare programs and services is explored.

*Pending final approval

HSA-HPM-POP 223c,d. Health Planning in Developing Countries (formerly HSA-POP 223c,d.)

Lectures, seminars. *One 2-hour session each week.*

Laboratory. *One 1-hour session each week (optional).* 2.5 units. Dr. Cash, Mr. Hsiao, Dr. Shepard

Deals with the disciplinary content and methodologies of health planning through lectures, seminars, and case studies. Strong emphasis is placed on the economic analysis of health issues in developing countries. Selected concepts and techniques of microeconomics, cost effectiveness, and cost benefit are presented and applied to health care programs. These techniques are then incorporated into a health planning context in analyzing selected health plans and in writing a health plan. Emphasizes practical and applied work. ID 209a,b is recommended, but not required. A background in economics is not required.

POP-HSA-HPM 235c,d. The Design and Management of Population Programs (formerly POP-HSA 235c,d.)

Case discussions, seminars. *Two 2-hour sessions each week.* 5 units. Dr. G. Berggren, Dr. Wray, Dr. Ewbank, Dr. Wyon, Dr. H. Strachan (Visiting Associate Professor of Business Administration, Harvard Business School). (Course described under Population Sciences.)

HSA-HPM 300,a,b,c,d,e. Tutorials

Time and credit to be arranged.

Students may make individual arrangements to do work under the guidance of a member of the Division. This work may include readings or special projects.

HSA-HPM 330. Field Work

Time and credit to be arranged.

Students are assigned to work on special projects such as group surveys, other types of field projects, or observation of and limited participation in the work of health agencies. Field assignments are made on an individual basis to meet the needs of each student insofar as possible. Work in the field is coordinated with courses in the Division.

- 332 *Cooperative Health Improvement Project*
Summer full-time or weekly part-time placement in local communities.
Credit to be arranged.

HSA-HPM 350. Research

Doctoral candidates may register for HSA-HPM 350 to undertake individual study and research.

Maternal and Child Health and Aging

MCHA 101. Child Growth and Development

Self-instructional course. *May be taken any period.* 2.5 units. Dr. Valadian, Dr. DeLollis. Individualized instruction in the physical growth, development, and maturation of children is presented in self-paced programmed material, supplemented by conferences and additional readings as needed. Covers topics which are necessary for advanced study of growth and development and which are basic for students who plan to be involved in medical or related social and educational services for children.

MCHA 201b,201c. Child Growth and Development II: Advanced Seminar

Seminars. *One 2-hour session each week.* 2.5 units (or 1.5 units if only one period elected). Dr. Valadian, Dr. DeLollis.

Deals in depth with the physical growth and development and the maturation of children ("b" period) and with the factors affecting them ("c" period). Either period may be taken separately. A term paper is required of all students, whether they take the "b" period, the "c" period, or both, and may be done in either period.

Prereq. MCHA 101 or permission of the instructor.

MCHA 202b. Primary Maternal and Child Health Care

Seminars, field visits. *One 2-hour session each week.* 1 unit. Dr. Valadian, Staff of the Department.

Seminars and field observations focus on four different health programs in Boston. Faculty members participate in the visits and seminars, which are intended to relate the observed activities to maternal and child health and to crippled children's programs.

MCHA 203b. Content of Maternal and Child Health Services

Seminars. *Two 2-hour sessions each week.* 2.5 units. Dr. Valadian, Staff of the Department, Guest Lecturers.

Components of health care services to mothers and children are discussed as they vary to meet the changing needs resulting from growth and maturational processes. Health services appropriate to maternity, early and late child-

hood, adolescence, and youth are presented in terms of the multidisciplinary and interdisciplinary action they require. Prereq. Completion of MCHA 101, concurrent enrollment in MCHA 201b, or permission of the instructor.

MCHA 204c,d. Programs and Issues in Maternal and Child Health Services

Lectures. *Two 2-hour sessions each week. 5 units.* Dr. Valadian, Staff of the Department, Guest Lecturers.

Beginning with the historical background and the relationship of maternal and child health programs to social, mental health, education, and other systems, the course discusses factors which shape current and future maternal and child health policies and services. It considers the organization and administration of national, state, and local maternal and child health and handicapped children services and examines selected issues such as child abuse, lead poisoning, and day care.

Prereq. MCHA 201b and 203b or permission of the instructor.

MCHA 205d. Research Approach to Growth, Development, and Health of the Child

Seminars. *Two 2-hour sessions each week. 2 units.* Dr. Valadian, Dr. Reed.

Methods of obtaining and evaluating data on child growth, development, and health, and the construction of norms are studied, including the design of studies dealing with interrelationships among various aspects of the child's progress, background, and environment. Enrollment subject to approval of the instructors.

MCHA 206c,d. Maternal and Child Health in Developing Countries

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Wray.

Using readings, discussions, and case presentations, considers issues of high priority in the health of mothers and children in developing countries, placing particular emphasis on the interactions between health and poverty in societies in rapid social and cultural transition. Complements, but is not a substitute for, the issues raised in ID 209a,b. Considerable reading is required to fulfill the course objectives.

MCHA-NUT 207c,d. Nutrition in Child Growth and Development

Lectures, discussions. *One 2-hour session each week. 2.5 units.* Dr. Dwyer, Visiting Lecturers.

Principles and practical problems encountered in the nutritional aspects of child growth and development are examined. Lectures on general principles are designed to help students base their judgments on scientific evidence. Discussions deal with a variety of nutrition case studies and simulations illustrative of problems in both developing and highly industrialized countries.

MCHA 208c,d. Rural Health Services

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Wray, Dr. Wyon.

Discussion focuses on the characteristics of "rural culture" and on problems in identifying and providing for the health needs of isolated communities. Five areas of concern are examined: Appalachia, the black South, migrant workers, Indian health, and the rural not-poor. The concepts discussed are pertinent to developing countries as well as to the United States. After covering common issues, students work in small groups focusing on selected areas of interest. Field visits can be arranged.

MCHA 209c,209d. Social Services for Mothers and Children

Lectures, seminars. *Two 2-hour sessions each week. 2.5 units each period.* Dr. Deykin.

Services for children and families are examined in terms of welfare legislation and the social factors which delineate their needs. Factors pertinent to the utilization of established programs and the newer self-help groups are discussed. The "c" period focuses on services for children and the "d" period on services for adolescents and mothers.

MCHA 210b. An Introduction to Personality and Cognitive Development

Lectures, seminars. *Two 2-hour sessions each week. 2.5 units.* Dr. Walker.

The basic principles of child growth and development in the cognitive and the psychosocial domains are examined in this introductory course. Special emphasis placed on understanding the theories and research of Piaget, Freud, Erikson, and others, as well as the implications of these contributions to the planning and implementation of medical and/or related social and educational services for children and youth.

MCHA 211b. Health Care of Women

Seminars. *Two 2-hour sessions each week. 2.5 units.* Dr. Valadian.

Considers critical issues of health care and the common problems of women, including the changing role of women in contemporary United States society. These health problems are addressed in terms of their epidemiology and the impact of technology on the detection and treatment of these problems viewed from biological, medical, behavioral, and legal perspectives.

Enrollment limited to 20 students and subject to approval of the instructor.

Prereq. Basic knowledge of reproductive biology.

HSA-HPM-MCHA 212a,b. Human Rights in Health (formerly ID 208a,b.)

Lectures. *One 2-hour session each week. 3 units.* Dr. Curran.

(Course described under Health Services Administration.)

MCHA-BEH 237c,d. Child Development and Social Policy (Education P-220)

Seminars. *Two 1½-hour sessions each week. 5 units.* Dr. Walker.

Analyzes how knowledge of child development relates to the planning and implementation of social policy. Of primary concern is the relevance and utility of basic data from research and evaluation studies in psychology, pediatrics, and related disciplines in the creation of health and education programs and policies concerned with children and adolescents.

Prereq. Knowledge of basic child development and of research methodologies and statistics.

MCHA 300b,c,d,e. Tutorial Programs

Time to be arranged. 2 or more units.

Students may arrange to undertake an individual project or specialized reading under faculty supervision. Advance approval by the Head of the Department required.

MCHA 330. Field Study

One-week period between fall and spring terms. 1 unit.

Field study will be arranged on an individual basis to meet the special needs of each student insofar as possible.

Additional Field Study

Students who lack sufficient previous experience are encouraged to undertake a period of field study before registration or after completion of the academic year, in a program arranged by the staff of the Department. No credit is allowed for such field study.

MCHA 350. Research

Doctoral students may undertake research in maternal and child health or aging by arrangement with the Head of the Department.

Microbiology**MIC 201c,d. Case Studies in Public Health Planning and Decision Making**

Lectures, workshops. *One 1-hour and two 2-hour sessions each week. 5 units.* Dr. Nichols. Health planning and decision making are given equal attention using actual cases as teaching models. As members of small planning teams, students participate in decision making in the control of infectious diseases of public health importance (approximately one-half the course). Also included is the planning of preventive and curative health services in urban and industrial settings of a developing country. A background in biology is not required.

Enrollment limited and subject to approval of the instructor. No auditors.

MIC 202b. Critiques of Current Literature on Infectious Diseases

Seminars. *One 2-hour session each week. 1 unit.* Dr. Hermann, Dr. Grant.

Papers on topics of general interest are selected from current periodicals and critically reviewed as to soundness of experimental design, validity and significance of results and conclusions, organization of manuscript, and clarity of presentation.

MIC 203d. Clinical Problems in Infectious Diseases

Lectures, clinics. *One 2-hour session each week. 1 unit.* Dr. Louis Weinstein (Visiting Professor of Medicine, Harvard Medical School). Problem cases concerning diagnosis, treatment, and control of the common acute communicable diseases of temperate climates are presented, together with discussions of infectious diseases that are usually not considered communicable.

MIC 204b. Laboratory and Immunologic Aspects of Infectious Diseases

Lectures. *Two 1-hour sessions each week.* Laboratory. *Two 2-hour sessions each week. 2.5 units.* Dr. Hermann, Staff of the Department. Introduces the microbiologic and immunologic techniques currently utilized by research and diagnostic laboratories for studying infectious diseases. Characterization and diagnosis of infectious agents of current public health importance are stressed, as well as the immunological principles involved. Students per-

form in detail cultural and biochemical techniques for viruses, bacteria, and rickettsiae, and a variety of relevant immunological techniques.

Enrollment subject to approval of the instructor.

MIC 213d. Intracellular Microorganisms Pathogenic for Man

Laboratory exercises, seminars. *Two 3-hour sessions each week. 2.5 units.* Dr. Hermann, Dr. Nichols, Staff of the Department.

Provides an understanding of the techniques available for studying the growth and the characteristics of representative strains of rickettsiae, chlamydiae, and viruses which are human pathogens. Under staff supervision, each student performs the procedures for identification and characterization of unknown pathogens.

Enrollment limited to 16 students with prior approval of the instructors. The course will not be given if less than 6 students enroll.

Prereq. MIC 204b or equivalent.

MIC 214d. Case Studies in the Epidemiology of Infectious Disease

Seminars, laboratory exercises. *One 2-hour session each week. 1.25 units.* Dr. Nichols.

Deals with problems in the epidemiology of communicable and other acute diseases. Students will assume the role of investigator or control officer in the study of actual cases of epidemics and other acute disease control situations.

Prereq. BIO 101a,b or equivalent, EPI 201a, background in biology, and permission of the instructor.

MIC 216d. Sexually Transmitted Diseases

Lectures, seminars. *One 2-hour session each week. 1 unit.* Dr. Nichols, Guest Lecturers.

Discussion centers on why sexually transmitted diseases that are easily cured are out of control. Reviewed topics include: pathobiologic, epidemiologic, and biosocial aspects of venereal diseases, such as patterns of sexual behavior; lay and professional attitudes toward venereal disease and patients; and legal and economic aspects of control. Interaction of students from both social and medical sciences benefits the examination of possible new approaches for dealing with the problems.

MIC-TPH 217a. Virology

Lectures, seminars. *Three 1-hour sessions each week. 2.5 units.* Dr. Essex, Dr. Waner.
Not given 1979-80

Provides students with fundamentals of human virology and introduces the new and relevant concepts emanating from recent and ongoing research. Topics include: virus-host cell interaction, pathogenesis, chronic and latent infections, epidemiology, environmental factors, host defense mechanisms, and community control measures. Selected virus groups discussed in detail.

MIC 219c,d. The Molecular Biology of Cancer (Biophysics 203)

Lectures. *One 2-hour session each week. 5 units.* Dr. Haseltine, Dr. Chen (Assistant Professor of Pathology, Harvard Medical School).
Examines the nature of cancer at the molecular level and explores the differences between normal cells and tumor cells in tissue culture. Draws upon cell biology, viral oncology, tumor immunology, and genetics. Specific topics include viral and chemical carcinogenesis, genetics of cancer and the transformed state.
Prereq. Previous training in biochemistry, cell biology, and virology, and permission of the instructors.

MIC 300a,b,c,d. Tutorial Programs

Time and credit to be arranged. Staff of the Department.
Enrollment requires the consent of the staff member responsible for supervision of the research. The various subject areas are listed below by category.

301 *Chlamydiae*

Dr. Nichols.

Laboratory and field research in trachoma, inclusion conjunctivitis, psittacosis, lymphogranuloma venereum, and the diseases caused by the chlamydial agents in humans and animals. Students are welcome to do laboratory and, occasionally, field investigations.

302 *Viruses*

Dr. Essex, Dr. Herrmann, Dr. Cerny, Dr. Haseltine.

Isolation and identification of representative viruses by use of cell culture, animal inoculation, and serologic techniques.

303 *Immunochemical Methods*

Dr. Herrmann.

Experiments with immunofluorescence, chromatography, immunoelectrophoresis, enzyme-coupled antibody, labeled isotopes, and other techniques applied to research on microorganisms and mechanisms of hypersensitivity.

304 *Public Health Laboratory*

Associates at the State Laboratory Institute.

The State Laboratory Institute is engaged in a variety of programs related to public health. These include the development, preparation, and testing of new and standard serums, vaccines, and blood fractions; research in various aspects of applied immunology; various aspects of diagnostic service in the fields of bacteriology, virology, and congenital metabolic disorders; and field studies on arboviruses. Individual arrangements for study can be made in any of these programs.

305 *Tumor Biology*

Dr. Essex, Dr. Cerny, Dr. Grant, Dr. Haseltine.

Approaches and techniques for the study of cancer as an infectious disease. Procedures used to study tumor cell and tumor virus marker antigens and antibodies demonstrated. The significance of these markers for epidemiological, etiological, and diagnostic investigations of various tumor systems of known and unknown cause discussed. The relationship between the immune response and the oncogenic process examined.

306 *Cellular Immunology*

Dr. Cerny, Dr. Essex, Dr. Grant.

Differentiation of cells producing antibody of various classes *in vivo* and *in vitro*. The studies involve the use of a number of immunological methods, but principally the agar plaque technique. The major experimental model utilized is immune response to cell wall antigens of *Vibrio cholerae*. The research also involves experiments on interaction between antibody-forming cells and leukemic viruses in mice and studies on the mechanism of virus-induced immunosuppression.

307 *Venereal Disease*

Dr. Nichols.

The departmental research on venereal diseases, especially gonorrhea, and the chlamydial diseases spans biology, immunology, microbial physiology, and epidemiology. Student participation in ongoing project areas is encouraged.

308 *Health Problems in Selected Underdeveloped Countries*

Dr. Nichols.

Problems are studied in the historical context of their political, socioeconomic, and cultural development. Extensive reading assignments are discussed in small seminars. Students with experience in international health preferred.

MIC 350. Research

Qualified doctoral candidates, research fellows, and full-time special students may register for MIC 350 to undertake original research in virology, bacteriology, immunology, or in one of the disciplines available at the State Laboratory Institute. A number of the current research activities of the Department are indicated under MIC 300. Inquiries about specific research opportunities should be addressed to the Head of the Department.

Nutrition

NUT 201a,b. Principles of Nutrition

Lectures. *Two 2-hour sessions each week. 5 units.* Dr. el Lozy, Dr. Hayes, Dr. Thenen.

An in-depth study of the essential nutrients, with special attention to the problems of estimating human requirements. The consequences of nutritional deficiencies and excesses will be discussed.

Note: This course is similar to NUT 202 offered in previous years.

NUT 203c,d. Nutrition Policy Formation and Program Operation

Lectures, discussions. *Two 1½-hour sessions each week. 5 units.* Dr. Austin.

Deals with the formation of food and nutrition policies and the operation of nutrition intervention programs aimed at the major nutritional problems in the United States and in the developing nations. Employs a multidisciplinary and case study approach to develop skills in analyzing and formulating nutrition policies and plans, and to sharpen problem-solving and decision-making capacities regarding nutrition program operation.

Prereq. NUT 201a,b or NUT 210a,b or permission of the instructor.

NUT 204a,b; 204c,d. Departmental Seminars

Seminars. *Two 1-hour sessions each week. 2.5 units each semester.* Dr. Thenen, Staff of the Department.

Students participate in and present seminars reviewing current research and publications related to nutrition in addition to attending advanced seminars presented by faculty and guest speakers. Beginning students learn skills required for oral presentations. Topics include both basic research and applied areas of nutrition.

NUT 205c,d. Biochemistry and Physiology of Nutrition

Lectures. *Two 2-hour sessions each week. 5 units.* Dr. Hayes, Dr. el Lozy, Dr. Nicolosi, Dr. Thenen.

The biochemistry and physiology of carbohydrates, fat, protein, vitamins, and minerals are integrated from the nutritional perspective. Course provides an in-depth analysis for students with a major interest in nutritional biochemistry.

Prereq. Course in biochemistry and permission of the instructors.

NUT 206c,d. Laboratory and Animal Research Techniques

Lectures, demonstrations. *One 3-hour session plus 2 additional hours each week. 5 units.* Reduced credit may be arranged for students not majoring in nutrition. Dr. Geyer, Dr. Antoniadis, Dr. Nicolosi, Staff of the Department. Opportunity to learn the principles and practice of modern experimental animal and laboratory research techniques by means of discussions and laboratory work. The course involves both instrument-oriented and project-oriented exercises. The latter includes studies with animals and/or mammalian cell cultures as well as subcellular systems.

MCHA-NUT 207c,d. Nutrition in Child Growth and Development

Lectures, discussions. *One 2-hour session each week. 2.5 units.* Dr. Dwyer, Visiting Lecturers. (Course described under Maternal and Child Health and Aging.)

NUT 208c,d. Nutritional Aspects of Human Disease

Lectures, case presentations, discussions. *One 2-hour session each week. 2.5 units.* Dr. Herrera-Acena, Dr. el Lozy, Mrs. Witschi, Staff of the Nutrition and Dietetics Department, Peter Bent Brigham Hospital. Reviews the role of diet in the causation and management of clinical obesity, diabetes mellitus, coronary artery disease, anemia, liver disease, alcoholism, gastrointestinal disorders, and renal disease. Early detection and prevention of these nutrition-related disorders considered.

NUT 209a,b. Food Science and Nutrition

Lectures, discussions. *Two 1-hour sessions each week. 2.5 units.* Mrs. Witschi, Dr. Samonds, Staff of the Department.

Deals with nutrition in terms of the foods which supply mankind's nutrient needs, their composition and physical properties, and the positive and negative effects on nutrient qualities of food of genetic manipulation, agricultural practice, processing, storage, and cooking. The historical development of food technology, including methods of preservation and sanitation, is related to current methods employed in both developing and industrialized countries.

NUT 210a,b. Nutrition Problems of Less Developed Countries

Lectures, discussions. *One 2-hour session each week. 2.5 units.* Dr. Herrera-Acena, Dr. Mora, Dr. Timmer.

The nutrition problems of less developed countries are discussed in the context of basic human needs. The ecology and the biological and behavioral consequences of malnutrition are reviewed in detail. Special emphasis on issues in human biology relevant to the formulation of nutrition policy and programs.

NUT 300a,b,c,d,e. Tutorial Programs

Time and credit to be arranged.

Individual work under direction may be arranged. This can include laboratory studies, projects in applied nutrition, or library research.

NUT 350-365. Research

Time and credit to be arranged.

Facilities are available for doctoral students to do advanced work in nutrition along the lines of fundamental or applied research as related to public health and medicine. Areas currently receiving intensive and comprehensive study in the Department are as follows:

- 351 Dr. Geyer
Effects of growth factors and hormones on the metabolism of human cells in culture; nutrition and metabolism of isolated organs; complete blood replacement *in vivo* with artificial preparations.
- 352 Dr. Hegsted (On leave of absence 1979-80)
The nutritive value of proteins and protein requirements; dietary effects on the metabolism of cholesterol in animals and man; the influence of diet on the metabolism of adipose tissue; nutritional requirements for calcium and for bone formation.
- 353 Dr. Lown
Coronary artery disease; etiology of sudden death; derangements of the heart beat; exercise physiology; electrolyte metabolism.
- 354 Dr. Stare
The effect of nutrition and other environmental factors on the etiology of heart disease in man; nutrition education, particularly of the public; fluoride in human nutrition as a preventive for tooth decay and osteoporosis.

- 355 Dr. Timmer
Measuring and predicting the nutritional impact of government policies, particularly non-nutrition policies; the formation and evolution of rice policies in Asia; rural development.
- 356 Dr. Antoniades
Regulation of cell growth by hormonal growth factors derived from human serum or platelets; platelet-derived growth factor and atherogenesis; mechanisms of hormone transport and regulation.
- 357 Dr. Hayes
Nutritional pathology with specific interest in diet and disorders of lipid and lipoprotein metabolism, particularly atherogenesis in non-human primates.
- 358 Dr. Herrera-Acena
The role of nutrition and other environmental factors in the etiology and management of diabetes mellitus; the relationship of malnutrition to physical and cognitive development.
- 359 Dr. el Lozy
The quantitation of malnutrition in children in developing countries on the basis of anthropometric measurements; in association with members of the Department of Biostatistics, studies of mathematical models of growth (mainly human, but also to a lesser extent animal); application of these models to the study of growth in chronic diseases of childhood (diabetes, cystic fibrosis, etc.).
- 360 Dr. Mora
The epidemiology of malnutrition, physical growth deficit, and cognitive retardations.
- 361 Dr. Thenen
Early development and the role of nutrition in obesity and insulin resistance in experimental animal models; effects of marginal folic acid deficiency on reproduction, hemopoiesis and resistance to infection; biochemical defects in vitamin B₁₂ deficiency.
- 362 Dr. Verrier
Influence of neural factors, psychologic conditioning, and myocardial ischemia on susceptibility to ventricular arrhythmias and sudden death.

- 363 Mrs. Witschi
Computer-based interactive dietary history, analysis, and counseling programs.
- 364 Dr. Austin
Cost effectiveness of infant and child supplemental feeding in the United States. Cost-benefit methodology for assessing safe levels of food additives.
- 365 Dr. Huber
Trace mineral metabolism.
- Admission limited and subject to approval of the instructor.

The following courses, offered in the Faculty of Arts and Sciences, may be of particular interest to students of nutrition.

Economics 1261. The World Food System
Half course (*fall term*). Tu., Th., at 11 and a discussion hour to be arranged. Timmer.
Prereq. Economics 10 or permission of instructor.

Dd-102. Dudley House Seminar: Blood
Half course (*spring term*). Tu., 3-5. Antoniades.
Note: Enrollment limited to 20.

Physiology

PHY 203a,b. Human Physiology

Lectures, conferences, demonstrations. *Two 1-hour and one 2-hour sessions each week. 5 units.* Dr. Mead, Dr. Valberg, Staff of the Department.

Students lacking a background in biology are offered an intensive introduction to biological principles and to the physiology of cells, organ systems, and organisms. Some pathophysiology and a number of laboratory exercises are included.

Prereq. College courses in physics, chemistry, and mathematics, or permission of the instructor.

PHY 205c,d. Principles of Toxicology

Lectures, seminars. *Two 2-hour sessions each week. 5 units.* Dr. Tashjian, Staff of the Laboratory of Toxicology.

Emphasis placed on mechanisms of injury resulting from chemicals that enter organisms without purposeful intent at the molecular, cellular, organ system, and organismal levels. Methods used to detect, evaluate, analyze, and combat the toxic effects of chemicals discussed. Prereq. Organic chemistry, biological chemistry, and mammalian physiology.

PHY 206a,b. Pulmonary Cell Biology

Lectures. *One 2-hour session each week.*

Laboratory. *To be arranged. 5 units.* Dr. Sorokin, Dr. Brain, Staff of the Department, Guest Lecturers.

Given alternate years; 1979-80.

Surveys pulmonary structure and function, trachea to alveolus, from the viewpoint of cell biology. Examines biological properties of the more than 40 cell types present and considers how cell and tissue functions are integrated to provide for respiration, defense against airborne infection, and other metabolic functions. Knowledge gained in this course helps prepare the student for research on the lungs and helps give insight into pulmonary disease. Prereq. College-level course in histology or cell biology and permission of the instructors.

Note: During 1979-80, PHY 206a,b will be taught with PHY 272a,b during the "a" period only.

PHY 207c,d. Radiation Biology

Lectures. *Three 1-hour sessions each week. 4 units.* Dr. Little.

This course is divided into two parts: cellular and mammalian radiobiology. The first includes radiation chemistry; cell survival, transformation, and mutagenesis; cytogenic effects; UV-photobiology; and cellular and molecular repair processes. The second covers effects of radiation in man and characteristics of internal and external human exposure. The biologic basis of the acute radiation syndrome, and the human epidemiologic data for radiation carcinogenesis, are emphasized.

Prereq. PHY 203a,b or college-level course in biology.

PHY 208a,b, 208c,d. Seminar in Toxicology

Seminars. *One 1-hour session each week. 1 unit each semester.* Dr. Tashjian, Staff of the Department.

Not given 1979-80.

Seminars, journal clubs, and discussions of topics in basic research and the current literature in toxicology and related fields.

Prereq. Background in toxicology and permission of the instructor.

PHY 210a,b. Advanced Toxicology

Lectures, discussions, seminars. *One 2-hour session each week.*

Laboratory. *To be arranged. 5 units.* Dr. Tashjian, Staff of the Department.

Not given 1979-80.

Examines experimental methods of research in toxicology. Includes individual laboratory work.

Prereq. PHY 205c,d or equivalent and permission of the instructor.

PHY 212a,b. Environmental Carcinogenesis

Lectures, seminars. *One 1-hour and one 2-hour session each week. 5 units.* Dr. Kennedy, Dr. Eisenstadt.

Considers the various factors involved in carcinogenesis and mutagenesis induced by environmental agents, emphasizing the biological basis of the *in vitro* and *in vivo* systems used for the evaluation of potential environmental carcinogens. Major areas include: enzymatic activation of chemical carcinogens, DNA damage and repair in bacteria

and mammalian cells, mutation in bacteria and mammalian cells, mammalian cell transformation, and animal carcinogenesis.

Prereq. College-level cell/animal biology, PHY 203a,b or equivalent, or permission of the instructors.

PHY 272a,b. Structure and Function of the Mammalian Respiratory System (Biology 272)

Lectures. *One 3-hour session each week.*

Demonstrations, discussions. *To be arranged. 5 units.* Dr. Weibel, Dr. Brain, Dr. Leith, Dr. Mead, Dr. McMahon (Professor of Biology, Division of Applied Sciences), Dr. Taylor (Professor of Biology, Faculty of Arts and Sciences). Given only 1979-80.

An introduction to the structure and morphology of the respiratory system of mammals (from lung to mitochondria) integrating structural and morphometric information with physiological data. Requirements include lectures, demonstrations, discussions, term paper, and oral presentations.

Prereq. College-level course in histology or cell biology.

PHY 300. Tutorial Programs

Time and credit to be arranged.

Opportunities are provided for tutorial work in the fields of respiratory physiology, toxicology, occupational medicine, and radiobiology.

PHY 350. Research

Doctoral candidates may undertake laboratory or field research under the direction of faculty members working in the following areas:

Occupational health

Dr. Peters, Dr. Wegman, Dr. Fine.

Radiobiology and experimental carcinogenesis

Dr. Little, Dr. Kennedy.

Pulmonary biology

Dr. Mead, Dr. Brain, Dr. Butler, Dr. Feld-

man, Dr. Hoppin, Dr. Leith, Dr. Sorokin,

Dr. Valberg.

Toxicology

Dr. Tashjian, Dr. Richardson, Dr. Schonbrunn, Dr. Rice.

Community air pollution

Dr. Ferris.

Population Sciences

POP-BEH 130a,b. The American Household in Demographic Perspective

Lectures. *Two 1½-hour sessions each week. 5 units.* Dr. Masnick.

Examines in the context of longer historical trends the recent dramatic changes in family structure brought about by changes in patterns of household formation, marriage, separation, divorce, remarriage, childbearing, female labor force participation, and mortality. Implications for elements of the social order receive emphasis, including general integration of age structure, characteristics of the labor force, familial support in health care, and the housing market.

POP 185a,b. Applied Mathematical Demography (Sociology 185)

Lectures. *Two 1½-hour sessions each week. 5 units.* Dr. Keyfitz.

Topics include: probabilities of survival and of childbearing; the general one-sex model and the stable special case; parity and interbirth intervals; cohorts and periods; and extension to two sexes and to changing rates of birth and death. Also covered are application to population prediction, inferring birth rates from censuses, occupational mobility, migration, kinship, and effects of birth control.

Prereq. One year of calculus.

POP 191a,b. The Spatial Aspects of Societies (Sociology 191)

Lectures. *Two 1-hour sessions each week. 5 units.* Dr. Alonso.

Stresses the interaction of societies and their geography, focusing primarily on the historic and current development of the United States. Consideration is given to technology, institutions, ideology, health, the economy, and other factors influencing the growth and shape of cities, their relations to each other and to rural areas.

POP 200a,b. Introduction to Population Sciences

Lectures. *Two 1-hour sessions each week. 2.5 units.* Dr. Ewbank, Staff of the Department.

Reviews the basic interrelationships among fertility, mortality, and migration. Their interaction with social, cultural, and economic characteristics of societies is discussed for countries at each stage of the demographic

transition, i.e., for both developed and developing countries. Introduces basic demographic concepts and methods, including age-sex pyramids, life tables, demographic rates, and kinds of surveys needed for collection of data.

POP 201a,b. Introductory Seminar on Population Sciences

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Ewbank, Staff of the Department.

Supplements the introduction to population sciences presented in POP 200a,b. Most students will be concurrently enrolled in 200a,b. Topics include: basic physiology of human reproduction, contraceptive methods, population ethics, design of population programs, relationship between population growth and economic development, and contraceptive use in the United States. Several short papers will be required.

Prereq. Previous or concurrent enrollment in POP 200a,b.

POP 202c,d. Departmental Seminar

Seminars. *One 2-hour session each week. 2.5 units.* Dr. Wyon, Staff of the Department.

Oriented toward health and population problems of communities. Each student selects a community and an appropriate health or population problem. He/she presents a critical survey of the relevant literature and a project design, to amplify understanding of the relative frequency of the selected problem in relation to other health or population problems of the community, and to increase or test the available knowledge of causes of the problem.

POP 203c. Basic Demographic Methods

Seminars. *Two 2-hour sessions each week. 2.5 units.* Dr. Masnick, Dr. Ewbank.

Introduces the conceptual tools that are basic to any demographic analysis. Topics include: fertility rates, life tables, population projection, analysis of age structures, and the relationship between period and cohort data. It is expected that most students will continue on to POP 205d and/or POP 206d.

POP 204c,d. Biological Basis for Fertility Control

Lectures. *Two 1-hour sessions each week, with a third hour at the discretion of the instructor.*

Laboratory. *Six 2-hour sessions, to be arranged. 5 units.* Dr. Salhanick, Staff of the Department.

Presents the fundamental physiology and biochemistry related to known and potential methods of family planning. Topics include: the biosynthesis, secretion, effects, and modes of action of the gonadal and gonadotropic hormones; and the relationship of the natural steroid hormones to synthetic analogues is also discussed. Laboratory sessions include demonstrations of a family planning clinic, an infertility unit, and procedures for sterilization and pregnancy termination.

Prereq. POP 200a,b and appropriate science background.

POP 205d. Population Analysis in Developing Countries

Lectures. *Two 2-hour sessions each week. 2.5 units.* Dr. Ewbank.

Presents the basic methods for demographic analysis of populations in developing countries. Includes techniques for estimating fertility and mortality rates in the absence of reliable vital statistics; survey approaches to intensive study of small areas, including analysis of birth intervals, mortality patterns, and migration streams; and an introduction to the measurement of the impact of family planning and health programs.

Prereq. POP 203c.

POP 206d. Population Analysis in the United States

Lectures. *Two 1½-hour sessions each week. 2.5 units.* Dr. Masnick.

Introduces the data and techniques for population analysis as a part of planning and evaluation in health and social service professions. Different population units are examined with focus on the consequences of change in population structure for service delivery. Cases include local community hospital bed needs, rapid population change in an exurban area, changing composition of an urban population, forecasting the Boston area population, among others.

Prereq. POP 203c.

POP 209a,b. Foundations of Agricultural Sciences (Biology 195)

Lectures, seminars. *Two 1½-hour sessions each week. 5 units.* Dr. Levins.

Examines patterns of world food production as it develops from the interaction of social and biological systems: evolution of agro-ecosystems, principles of plant growth and productivity, pests and diseases, ecology of farming systems, consequences of technical choices, issues of agricultural change, and research strategies.

Prereq. Course in biology or permission of the instructor.

POP 209c,d. Population Biology

Lectures. *Two 1½-hour sessions each week. 5 units.* Dr. Lewontin, Dr. Levins.

Approaches population studies from a general biological standpoint. Attempts to integrate population and community ecology, population genetics, and biogeography. Topics include: the structure of the environment in space and time and its interaction with organisms, simple single-species growth dynamics, age-dependent demography, two-species interactions, multiple-species community dynamics, evolution of the niche, elements of population genetics, and topics in biogeography.

Prereq. College courses in calculus and biology.

POP 212c,d. An Economic Approach to Population Policy

Lectures. *One 2-hour session each week, with a third hour at the discretion of the instructor. 5 units.* Dr. Repetto.

Presents the economics relevant to the formulation and evaluation of population policies in developing countries and surveys knowledge about the effectiveness of intervention strategies. Covers welfare economics of population policies; interactions between fertility and economic development; the impact on population growth of policies which affect incomes, education, survivorship, old-age security, and related variables, as well as conventional family planning programs.

Prereq. POP 200a,b and HSA-HPM 205a,b or equivalent.

POP 216c,d. Comparative Analysis of Public Policies in Developing Countries (Government 211)

Lectures, seminars, workshops. *One 2-hour session each week. 5 units.* Dr. John D. Montgomery (Professor of Public Administration, John F. Kennedy School of Government). Examines patterns of policy making across cultures and issue areas, including interactions between policies and social contexts. Surveys Third World policies for dealing with such problems as population (fertility and migration); malnutrition; land reform; and management of large-scale irrigation systems. Applies the policy sciences approach to the formulation and implementation of large-scale programs of public intervention in social processes.

POP 217c. Introduction to Community Diagnosis of Birth and Death Rates in Developing Countries

Lectures, discussions. *One 2-hour session each week. 1.25 units.* Dr. Wyon.

Helps students distinguish within communities those kinds of persons at high risk of serious illness, death, and unwanted births. It uses data from studies at national and local levels to trace underlying causes of these events as the basis for designing feasible, effective, and simple preventive measures. Provides foundation for POP 202c,d and for other health and population courses considering policies and programs.

Prereq. Introductory courses in biostatistics, epidemiology, and (preferably) population sciences.

HSA-HPM-POP 223c,d. Health Planning in Developing Countries

Lectures, seminars. *One 2-hour session each week.*

Laboratory. *One 1-hour session each week (optional). 2.5 units.* Dr. Cash, Mr. Hsiao, Dr. Shepard.

(Course described under Health Services Administration.)

POP-HSA-HPM 235c,d. The Design and Management of Population Programs

Case discussions, seminars. *Two 2-hour sessions each week. 5 units.* Dr. G. Berggren, Dr. Wray, Dr. Ewbank, Dr. Wyon, Dr. Harry Strachan (Visiting Associate Professor of Business Administration, Harvard Business School), Staff of the Department.

Addresses, from a managerial perspective, the problems of developing and implementing population programs in Third World nations. Problems are examined from the level of the community, the program manager, and the national development planner. Topics covered primarily through case studies based on family planning, health, nutrition, and rural development programs. Stress placed on programs involving rural community members in program implementation.

Preference given to persons with Third World experience and professional commitment to Third World social development.

POP 285c,d. Applied Mathematical Demography Seminar (Sociology 285)

Seminars. *One 2-hour session each week. 5 units.* Dr. Keyfitz.

Consists of research on the topics of POP 185a,b.

Enrollment subject to approval of the instructor.

POP 286c,d. Formal Models of Movement (Sociology 235)

Seminars. *One 2-hour session each week; additional individual consultations to be arranged. 5 units.* Dr. Alonso.

Not given 1979-80.

Reviews a broad variety of models of movement of populations and other types of movement, from the social sciences and possibly from the natural sciences. A detailed examination of the structure, assumptions, and uses of these models is presented. An effort is made to place them within a common theoretical structure and to compare their assumptions and implications.

POP 300. Tutorial Programs

Time and credit to be arranged.

Students at the master's level may make arrangements for tutorial work and special reading on topics related to population problems. There may be an opportunity to consider the design of studies, programs, or analysis of data.

POP 330e. Field Studies

During the week between the fall and spring semesters and/or a week at the end of the academic year. Dr. G. Berggren, Dr. W. Berggren.

Field Trip to Haiti

The objective of this field study is to provide exposure to the urban, rural, and development problems of a developing country. Students visit the homes of rural farmers to observe the living conditions of these families and their accessibility to health care facilities and programs. Students also see rural health centers, health surveillance teams, nutrition programs, and the headquarters of various health programs. What has been observed, how it relates to data previously collected, and what programs can be developed to improve the conditions are then discussed with the group's leaders and with local health planners. Enrollment limited to 10 and subject to approval of the instructors.

Field Trip to the Dominican Republic

The objective of this field trip is very similar to that above; however, greater emphasis is placed upon family planning problems and programs in the Dominican Republic. Students will visit health centers, maternal and child health and family planning programs, and the headquarters of various health programs. These observations form the basis of discussions between the students, group leaders, and local health planners about what is being done and what can be done to solve the problems. Mr. Luis Gonzalez, an alumnus of the School and Head of Family Planning in the Dominican Republic, is the host for this visit. Enrollment limited to 6 and subject to approval of the instructors.

Note: One or both of these field trips may be made available during an academic year.

POP 350-355. Research

Time and credit to be arranged.

Candidates for doctoral degrees may undertake research in the Department or may integrate research in population sciences with a doctoral program in another department or at the Center for Population Studies.

Members of the Department and of the Center for Population Studies are currently engaged in research in the following areas:

- 350 *Field studies and programs*
Dr. Wyon, Dr. Plank, Dr. Guerrero, Dr. A. Berggren.
- 351 *Biomedicine and reproductive physiology*
Dr. Salhanick.
- 352 *Demography*
Dr. Keyfitz.
- 353 *Population ethics*
Dr. Dyck, Dr. Potter.
- 354 *Population economics*
Dr. Repetto.
- 355 *Complex systems*
Dr. Levins.

The following courses, offered by other faculties of Harvard University, are among those that may be of particular interest to students of population sciences. They are open to qualified students from the School of Public Health.

Ethics 284. Seminar: Ethical Aspects of Population Policy

Half course (*spring term*). *Hours to be arranged.* Potter and Dyck. (Offered at Harvard Divinity School).

Sociology 103. The Material Basis of Society Not given 1979-80.

Half course (*spring term*). M., W., (F), at 1. Keyfitz. (Offered in the Faculty of Arts and Sciences).

Sociology 251. Seminar: Social Policy and Population Issues in the Developed Countries Half course (*spring term*). M., 2-4. Alonso.

A broad range of issues in the developed countries, including education, health, housing, social security, status of women, labor policy, racial and group prejudice, are affected by declining fertility, growing up of the baby boom generation, and international migration. Stresses social processes involved and the policy responses proposed and tried out. (Offered in the Faculty of Arts and Sciences.)

Sanitary Engineering

ENG SCI 171. Chemistry of the Aqueous Environment

Half course (*fall term*). M., W., F., at 11. Professor Butler.

To be given 1980-81.

Chemical principles applicable to environmental science and engineering. Emphasis on pH, complex formation, and solubility in multicomponent systems. Principles of analytical chemistry and their application to analysis of water. Sources, occurrence, and chemical reactions of important constituents in natural waters.

Prereq. CHEM 10 or equivalent.

ENG SCI 173. Introduction to Environmental Microbiology

Half course (*spring term*). M., W., (F.), at 11, and laboratory hours to be arranged. Professor Mitchell.

Introduction to the ecology of microorganisms. Emphasis on microorganisms as functioning members of ecosystems. Critical examination of the role of microorganisms in water pollution, water-borne diseases, biological control, and water purification.

Prereq. BIO 1 or BIO 19.

ENG SCI 174. Concepts and Methods in Microbial Ecology

Half course (*fall term*). M., W., (F.), at 9, and laboratory hours to be arranged.

To be given 1980-81.

An analytical examination of concepts and research methods related to four fundamental questions in microbial ecology: How many microorganisms exist in different ecosystems? What are their activities *in situ*? What is the nature of microbial communities? What biological interrelationships exist among microorganisms? Four open-ended laboratories will assist in answering these questions.

Prereq. MATH 1; BIO 19 or BIO 154; BIO 12 or ENG SCI 173.

ENG 250a. Design of Water Resource Systems

Half course (*fall term*). Tu., Th., 9:30-11. Professor Thomas.

Principles of engineering and economic analysis applied to water resource systems. Func-

tional design of comprehensive management systems for collection, storage, conveyance, treatment, and distribution of water. Uses techniques of operations research and econometrics to develop methods for planning integrated systems of dams, reservoirs, canals, pipelines and networks, pumps, and treatment plants.

Prereq. APPL MATH 105a; ENG SCI 121, 123 or equivalents.

ENG 250b. Design of Water Resource Systems

Half course (*spring term*). Tu., Th., 9:30-11. Professor Thomas.

Continuation of ENG 250a, with emphasis on nonlinear systems and systems with stochastic components. Application to multiunit systems for industrial, municipal, and agricultural water supply, navigation, hydropower, conservation of wildlife, and the preservation and enhancement of the environment.

Prereq. ENG 250a; STAT 190 or equivalent desirable.

ENG 253. Stochastic Processes in Environmental Engineering

Half course (*fall term*). Hours to be arranged.

Professor Fiering.

To be given 1980-81. Alternates yearly with ENG 254.

Theory and applications of stochastic processes and time series for environmental problems, including hydrology, birth-death processes, hazard perception, storage systems, queues, Markov chains, multivariate techniques, and spectral analysis.

Prereq. ENG 250a, ENG SCI 118, or equivalent.

ENG 257. Seminar: Models for Environmental Systems Planning

Half course (*throughout the year*). Tu., 12-2. Professor Fiering.

Critical evaluation of current systems applications; biology and chemistry in environmental science, with emphasis on models for the analysis of water quality standards, optimality, and resilience in water-resource systems. Papers and presentations are required. Students intending to enroll should meet with Professor Butler to arrange scheduling before study cards are due.

ENG 270. Engineering Systems for Environmental Control

Half course (*spring term*). M., W., F., at 10. Professor Harrington.

To be given 1980-81.

Provision of urban water; engineering aspects of the collection and disposal of spent water and solid wastes; significant interchanges between the gaseous, liquid, and solid phases of the environment; geographic interchanges; time-dependent developments. Data collection and processing for monitoring and control; maintenance and operation of pollution control systems.

Prereq. ENG SCI 123 or permission of instructor.

Note: To be offered if 10 or more students enroll.

ENG 272. Water Quality and Its Management

Half course (*spring term*). Tu., Th., 11-12:30. Professor Morris.

To be given in 1980-81.

Nature, sources, and effects of inorganic and organic impurities in natural waters. Water quality standards. Effects of contaminating and polluting discharges on water quality. Natural purification of surface waters. Chemical and biochemical transformations in lakes and rivers.

Prereq. ENG SCI 171 and 173.

ENG 274. Chemical Models of Natural and Polluted Waters

Half course (*spring term*). Tu., Th., 1-2:30. Professor Butler.

To be given 1980-81.

Chemical aspects of aqueous environmental systems. Mathematical models include thermodynamic, kinetic, biological, and hydrodynamic processes. Applications to water quality management, pollution control, limnology, oceanography, and geology.

Prereq. Physical chemistry (e.g., CHEM 11, ENG SCI 171) and some experience in computer programming.

ENG 276. Treatment of Water Supplies and Wastewaters

Half course (*spring term*). Tu., Th., 11-12:30. Professor Morris.

Quality standards for water supplies. Processing of natural water for municipal use, including coagulation, softening, deferrization, disinfection, adsorption, and demineralization.

Physical, chemical, and biological treatment of wastewaters, including "advanced" methods. Prereq. ENG SCI 171 or permission of instructor.

ENG 278. Rate Processes

Half course (*fall term*). M., W., F., at 9. Professor Morris.

Kinetics of physical and chemical reactions, with emphasis on aqueous systems. Kinetic data and their interpretation. Mechanisms of inorganic reactions. Reaction dynamics in environmental engineering.

Prereq. ENG SCI 171 or equivalent.

Tropical Public Health

TPH 201a. Ecology, Epidemiology, and Control of Important Parasitic and Viral Diseases of Developing Areas

Lectures, seminars, demonstrations. *Four 1-hour sessions each week. 3 units.* Dr. Weller, Staff of the Department.

Provides an introduction to ecological and epidemiologic concepts basic to the control of infectious agents. Considers important parasitic and viral diseases of particular significance in the developing areas of the world. Epidemiologic principles of vector-associated diseases are elucidated through study of entities such as malaria and schistosomiasis. Prior knowledge of the pathogenesis of disease produced by infectious agents is desirable.

TPH 203d. Perspectives in Tropical Health: The Background for Decision Analysis

Lectures, conferences. *One 2-hour session each week. 1 unit.* Dr. Weller, Guest Lecturers.

Provides background information on environmental, social, economic, and political factors that influence health programs in the tropics. At each session a distinguished guest lecturer covers an assigned topic, including subjects such as the development of professional education, problems of agriculture, nutrition, and water supply, and the political background of international cooperation. Each presentation followed by informal student discussion. Enrollment open to all students.

TPH 204c. Introduction to the Techniques of Investigation of Parasitic Infections

Lectures, laboratory, seminars. *Two 3-hour sessions each week. One 2-hour additional laboratory session each week, to be arranged. 5 units.* Dr. Pan, Dr. Coolidge, Dr. Hoff.

Emphasizes laboratory methods for the study of parasitic diseases of public health importance. Provides exposure to theory and application techniques essential to epidemiologic and laboratory investigation. Life cycles of several parasites maintained and examined with respect to detection and quantification of infection, immunity, and control.

Enrollment limited to 15 and subject to approval of the instructors. Preference given to concentrators in tropical public health and microbiology.

TPH 205c. Clinical and Pathologic Features of Tropical Diseases

Case presentations, clinico-pathologic conferences, demonstrations. *One 2-hour session each week. 1 unit.* Dr. Weller, Dr. Coolidge, Dr. Boyer, Dr. Dammin, Dr. Franz von Lichtenberg (Professor of Pathology, Harvard Medical School), Staff of the Department.

Designed for students particularly interested in tropical medicine. Emphasis is on the clinico-pathologic aspects of tropical diseases. At each session disease entities are introduced by presenting a clinical case, and pertinent clinical and pathologic features of the disease are then reviewed.

Enrollment subject to approval of the instructors.

TPH 206d. Principles of Vector Biology

Lectures, laboratories, seminars, field trips. *Three 1-hour sessions and two 2-hour sessions each week. 5 units.* Dr. Michelson, Dr. Spielman.

The manner in which arthropods and molluscs transmit disease and the principles of vector control are discussed from ecological, physiological, and genetic points of view. Class sessions introduce concepts and techniques currently employed in controlling vector-borne disease. Weekend field trips provide an opportunity for students to apply skills acquired in the classroom.

Prereq. TPH 201a or suitable biology background, and permission of the instructors.

TPH 208d. Epidemiology and Control of Schistosomiasis

Seminars, laboratory exercises. *One 3-hour session each week. 2 units.* Dr. Michelson, Dr. Chernin, Dr. Pan, Dr. Weller.

Alternates yearly with TPH 210d; 1979-80.

The problems posed by schistosomiasis as an expanding health hazard are presented in a series of seminars and laboratory exercises. Emphasis is given to the biology of snail vectors, to problems of assessment of significance of the disease, and to the potentials of various approaches to control. Opportunity to become familiar with appropriate techniques is afforded in the laboratory.

Prereq. TPH 201a or permission of the instructors.

TPH 210d. Current Problems in Malariology
Seminars, laboratory exercises. *One 3-hour session each week. 2 units.* Dr. Chernin, Dr. Spielman, Dr. Weller, Staff of the Department. Alternates yearly with TPH 208d; 1980-81. Supplements the subject material on malaria offered in TPH 201a and TPH 204c. Particular attention is given to problems now encountered in eradication and control programs. In the laboratory, experience is provided with procedures essential to the epidemiologic investigation of malaria.
Prereq. TPH 201a and permission of the instructors.

MIC-TPH 217a. Virology
Lectures, seminars. *Three 1-hour sessions each week. 2.5 units.* Dr. Essex, Dr. Waner. Not given 1979-80.
(Course described under Microbiology.)

TPH 218d. Introduction to the Immunology of Parasitic Diseases
Lectures, discussions. *One 2-hour session each week. 1.25 units.* Dr. Boyer, Guest Lecturers. Provides an introduction to the immunology of parasitic diseases for students with a basic knowledge of immunology. Includes the general principles of immunology relating to the host-parasite relationship and the immunological aspects of selected parasitic diseases.
Prereq. Suitable course in basic immunology.

TPH 300a,b,c,d,e. Tutorial Programs
Laboratory exercises. *Time and credit to be arranged.*
Individual work for candidates at the master's degree level may be carried out under supervision of a member of the Department. Various parasites of medical importance are maintained and are available for studies on metabolism, host-parasite relationships, and chemotherapy. Arrangements subject to approval of the instructor.

TPH 350. Research
Doctoral candidates or qualified full-time special students may undertake original investigations in the laboratory or in the field by arrangement with the Head of the Department. Members of the Department are currently engaged in the following areas of research:

- 351 *Tissue culture and immunological techniques as applied to problems in medical virology*
Dr. Weller, Dr. Waner.
- 352 *Cultivation in vitro of parasitic helminths, protozoa, and other invertebrates of medical importance*
Dr. Weller, Dr. Chernin, Dr. Pan.
- 353 *Biology, host-parasite relationships, and control of molluscan vectors of schistosomiasis and of other parasitic infections*
Dr. Chernin, Dr. Michelson, Dr. Pan.
- 354 *Population genetics, nutrition, and reproduction of medically important arthropods*
Dr. Spielman.
- 355 *Arthropod transmission of viral, protozoan, and helminthic agents*
Dr. Spielman.
- 356 *Immunology of schistosomiasis*
Dr. Boyer, Dr. Weller.
- 357 *Epidemiology of Chagas' disease and schistosomiasis in rural Brazil*
Dr. Hoff.
- 358 *Mechanisms of health care in rural Haiti*
Dr. Berggren.

Officers of Instruction and Research

Members of the Faculty

William Alonso, A.B., M.C.P. (Harvard University); Ph.D. (University of Pennsylvania), Richard Saltonstall Professor of Population Policy.

Mary Ochsenhirt Amdur, S.B. (University of Pittsburgh); Ph.D. (Cornell University), Associate Professor of Toxicology (*Physiology*); Lecturer, Massachusetts Institute of Technology.

Harry Nicholas Antoniadou, B.S., Ph.D. (Athens University, Greece), Associate Professor of Biochemistry (*Nutrition*); Senior Investigator, Blood Research Institute, Inc., Boston.

James Edward Austin, A.A. (Flint Community Junior College); B.B.A. (University of Michigan); M.B.A., D.B.A. (Harvard University), Lecturer on Nutrition Policy and Programs (*Nutrition*); Associate Professor of Business Administration, Harvard Business School.

John Christian Bailar, III, A.B. (University of Colorado); M.D. (Yale University); Ph.D. (American University), Lecturer on Biostatistics; Editor-in-Chief, *Journal of the National Cancer Institute*, NIH, Bethesda, MD.

Colin Banks Begg, B.Sc., Ph.D. (Glasgow University), Assistant Professor of Biostatistics; Statistician, Sidney Farber Cancer Institute.

Robert Charles Benfari, A.B. (Colby College); M.B.A. (Babson Institute); Ph.D. (Yeshiva University); S.M. in Hyg. (Harvard University), Associate Professor of Psychology (*Behavioral Sciences*).

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Konrad Emil Bloch, Ph.D. (Columbia University), Professor of Science (*Nutrition*) in the Faculty of Public Health and Higgins Professor of Biochemistry in the Faculty of Arts and Sciences.

Elkan Rogers Blout, A.B. (Princeton University); Ph.D. (Columbia University), Member of the Faculty of Public Health; Dean for Academic Affairs (*Edward S. Harkness Professor of Biological Chemistry, Harvard Medical School*).

Leslie Irvin Boden, A.B. (Brandeis University); Ph.D. (Massachusetts Institute of Technology), Assistant Professor of Economics (*Physiology*).

Markley Holmes Boyer, A.B. (Princeton University); M.D. (University of Pennsylvania); D.Phil. (Magdalen College, Oxford University); M.P.H. (Harvard University), Assistant Professor of Tropical Public Health.

Joseph David Brain, A.B. (Taylor University); S.M., S.M. in Hyg., S.D. in Hyg. (Harvard University), Professor of Physiology.

Peter Braun, S.B. (Yale University); M.D. (Columbia University), Lecturer on Public Health (*Health Policy and Management*).

William Alfred Burgess, S.B. (Tufts University); S.M. (Harvard University), Associate Professor of Occupational Health Engineering (*Environmental Health Sciences*); Corporate Manager of Industrial Hygiene, Polaroid Corp.

James Preston Butler, A.B. (Pomona College); A.M., Ph.D. (Harvard University), Assistant Professor of Biomathematics (*Physiology*).

Richard Alan Cash, S.B. (University of Wisconsin); M.D. (New York University); M.P.H. (The Johns Hopkins University), Lecturer on Tropical Public Health; Institute Fellow, Harvard Institute for International Development.

Jan Cerny, M.D. (Charles University Medical School, Prague); Ph.D. (Czechoslovakia Academy of Sciences Institute of Experiment Biology and Genetics, Prague), Associate Professor of Immunology (*Microbiology*).

Gordon Chase, A.B. (Harvard University), Lecturer on Health Policy (*Health Policy and Management*).

Eli Chermin, S.B. (College of City of New York); A.M. (University of Michigan); S.D. (The Johns Hopkins University), Professor of Tropical Public Health.

Philip Timothy Cole, A.B. (Michigan State University); M.D. (University of Vermont); M.P.H., Dr.P.H. (Harvard University), Professor of Epidemiology.

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William John Curran, J.D. (Boston College); LL.M., S.M. in Hyg. (Harvard University), Frances Glessner Lee Professor of Legal Medicine in the Faculty of Medicine and the Faculty of Public Health (*Health Policy and Management and Maternal and Child Health and Aging*).

Richard Henry Daggy, S.B, S.M., Ph.D. (University of Minnesota); M.P.H., Dr.P.H. (Harvard University), Lecturer on Tropical Public Health.

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Arthur James Dyck, A.B. (Tabor College); A.M. (University of Kansas); Ph.D. (Harvard University), Mary B. Saltonstall Professor of Population Ethics; Member of the Faculty of the Harvard Divinity School.

Eric Eisenstadt, A.B., Ph.D. (Washington University), Assistant Professor of Biology (*Physiology and Microbiology*).

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Myron Elmer Essex, S.B. (University of Rhode Island); D.V.M., S.M. (Michigan State University); Ph.D. (University of California), Associate Professor of Virology (*Microbiology*); Scholar of the Leukemia Society of America, Inc.

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Lawrence Jay Fine, S.B. (University of Wisconsin); S.M., M.D. (University of Illinois); M.P.H., Dr.P.H. (Harvard University), Assistant Professor of Occupational Medicine (*Physiology*).

Harvey Vernon Fineberg, A.B., M.D., M.P.P., Ph.D. (Harvard University), Associate Professor of Health Services Administration (*Health Policy and Management*).

Melvin William First, S.B. (Massachusetts Institute of Technology); S.M., S.D. (Harvard University), Professor of Environmental Health Engineering (*Environmental Health Sciences*).

Howard Stanley Frazier, Ph.B. (University of Chicago); M.D. (Harvard University), Director of the Center for the Analysis of Health Practices and Member of the Faculty of Public Health; Professor of Medicine, Harvard Medical School.

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Steven Lawrence Gortmaker, A.B. (University of Michigan); S.M., Ph.D. (University of Wisconsin), Assistant Professor of Health Services (*Behavioral Sciences*).

Christopher Keith Grant, B.S., Ph.D. (University of London), Assistant Professor of Immunology (*Microbiology*).

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David Alan Hamburg, A.B., M.D. (Indiana University), Professor of Psychiatry (*Behavioral Sciences*) in the Faculty of Public Health and the Faculty of Medicine; Professor of Public Policy in the Faculty of Government; Chairman of the Division of Human Behavior and Health Policy, Department of Psychiatry, Harvard Medical School.

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D. Mark Hegsted, S.B. (University of Idaho); S.M., Ph.D. (University of Wisconsin); A.M. (hon.) (Harvard University), Professor of Nutrition (on leave 79-80).

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Frederic Gallatin Hoppin, Jr., A.B. (Harvard University); M.D. (Columbia University), Associate Professor of Physiology.

Donald Frederick Hornig, S.B., Ph.D. (Harvard University), Professor of Chemistry in Public Health (*Physiology*); Director of Interdisciplinary Programs in Health.

William Ching-Lung Hsiao, A.B. (Ohio Wesleyan University); M.P.A. (Harvard University), Associate Professor of Economics (*Health Policy and Management*); Member of the Faculty of Harvard Business School.

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William Monroe Keyserling, B.I.E. (Georgia Institute of Technology). S.M.E., S.M., Ph.D. (University of Michigan); Assistant Professor of Occupational Safety (*Physiology and Environmental Health Sciences*).

Richard Clark Killin, A.B. (University of Arizona); LL.B. (University of Michigan), Member of the Faculty of Public Health; Special Assistant to the Dean.

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C. Robin LeSueur, B.A., B.S.W. (University of Toronto); M.L.S. (Columbia University), Member of the Faculty of Public Health and the Faculty of Medicine; Librarian in the Francis A. Countway Library of Medicine.

Richard Levins, A.B. (Cornell University); Ph.D. (Columbia University), John Rock Professor of Population Sciences.

Richard Charles Lewontin, A.B. (Harvard University); A.M., Ph.D. (Columbia University), Member of the Faculty of Public Health (*Population Sciences*); Alexander Agassiz Professor of Zoology, Harvard University.

John Bertram Little, A.B. (Harvard University); M.D. (Boston University), Professor of Radiobiology (*Physiology*).

Thomas Arthur Louis, A.B. (Dartmouth College); Ph.D. (Columbia University), Associate Professor of Biostatistics.

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Mohamed Sayed el Lozy, M.B., B.Ch. (University of Cairo); M.D., Ph.D. (University of Alexandria), Assistant Professor of Nutrition.

John Morrison MacIntyre, S.B., Ph.D. (Massachusetts Institute of Technology), Assistant Professor of Biostatistics; Statistician, Sidney Farber Cancer Institute.

Brian MacMahon, M.D., D.P.H., Ph.D. (University of Birmingham, England); S.M. in Hyg. (Harvard University), Henry Pickering Walcott Professor of Epidemiology.

Morton Abraham Madoff, A.B., M.D. (Tulane University); M.P.H. (Harvard University), Lecturer on Applied Microbiology; Professor of Community Medicine, Tufts University School of Medicine.

George Stephen Masnick, A.B., A.M. (Cornell University); Ph.D. (Brown University), Associate Professor of Demography (*Population Sciences and Behavioral Sciences*).

Alfred Lee McAlister, A.B. (University of Texas at Austin); Ph.D. (Stanford University), Assistant Professor of Behavioral Sciences.

William Edward McAuliffe, A.B. (The Johns Hopkins University); A.M. (Washington University); Ph.D. (The Johns Hopkins University), Associate Professor of Sociology (*Behavioral Sciences*).

Colquitt Meacham, A.B. (Salem College); LL.B. (Emory University); LL.M. (Harvard University), Member of the Faculty of Public Health; Associate Dean for Student and Alumni Affairs.

Jere Mead, S.B., M.D. (Harvard University), Cecil K. and Philip Drinker Professor of Environmental Physiology (*Physiology*).

Charles Marie Joseph Mertens de Wilmers, M.D., Lic. en Psych. (Catholic University of Louvain, Belgium), Visiting Professor of Psychiatry (*Behavioral Sciences*); Professor of Medical Psychology, Faculty of Medicine, Catholic University of Louvain.

Edward Harlan Michelson, S.B., S.M. (University of Florida); Ph.D. (Harvard University), Associate Professor of Tropical Public Health.

William Leonard Mietlowski, S.B. (Canisius College); A.M., Ph.D. (University of Rochester), Assistant Professor of Biostatistics; Statistician, Sidney Farber Cancer Institute.

Olli Sakari Miettinen, M.D. (University of Helsinki); M.P.H., M.Sc., Ph.D. (University of Minnesota), Professor of Epidemiology and Biostatistics.

Farrokh Ziaollah Modabber, A.M., Ph.D. (University of California, Los Angeles), Lecturer on Microbiology; Associate Professor of Immunobiology, University of Teheran School of Public Health.

Dade William Moeller, S.B., S.M. (Georgia Institute of Technology); Ph.D. (North Carolina State College), Professor of Engineering in Environmental Health; Associate Director, Kresge Center for Environmental Health.

Richard Redding Monson, S.B. (North Dakota State University); M.D., S.M. in Hyg., S.D. in Hyg. (Harvard University), Associate Professor of Epidemiology.

Jose Obdulio Mora, M.D. (National University of Columbia); S.M. in Nutr. (Harvard University), Assistant Professor of Nutrition.

John Carrell Morris, S.B. (Rutgers University); A.M., Ph.D. (Princeton University); A.M. (hon.) (Harvard University), Gordon McKay Professor of Sanitary Chemistry (*Sanitary Engineering*).

Alan Sydney Morrison, A.B. (Harvard University); M.D. (Tufts University); S.M. in Hyg., S.D. in Epid. (Harvard University), Associate Professor of Epidemiology.

C. Frederick Mosteller, S.B., S.M. (Carnegie Institute of Technology); A.M., Ph.D. (Princeton University), S.D. (hon.) (University of Chicago); S.D. (hon.) (Carnegie-Mellon University), Roger Irving Lee Professor of Mathematical Statistics (*Biostatistics*); Member of the Faculty of Medicine, Harvard Medical School.

Raymond Leo Harrington Murphy, Jr., S.B. (College of the Holy Cross); M.D. (New York University); M.P.H., S.D. in Hyg. (Harvard University), Lecturer on Occupational Medicine (*Physiology*); Director, Pulmonary Service, Faulkner Hospital.

Raymond Kenneth Neff, A.B. (Dartmouth College); S.M. in Bio., S.D. in Bio. (Harvard University), Assistant Professor of Biostatistics; Director, Health Sciences Computing Facility.

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Roger Loyd Nichols, A.B. (Cornell College); M.D. (University of Iowa); A.M. (hon.) (Harvard University), Irene Heinz Given Professor of Microbiology; Associate Director, Center for the Prevention of Infectious Diseases.

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